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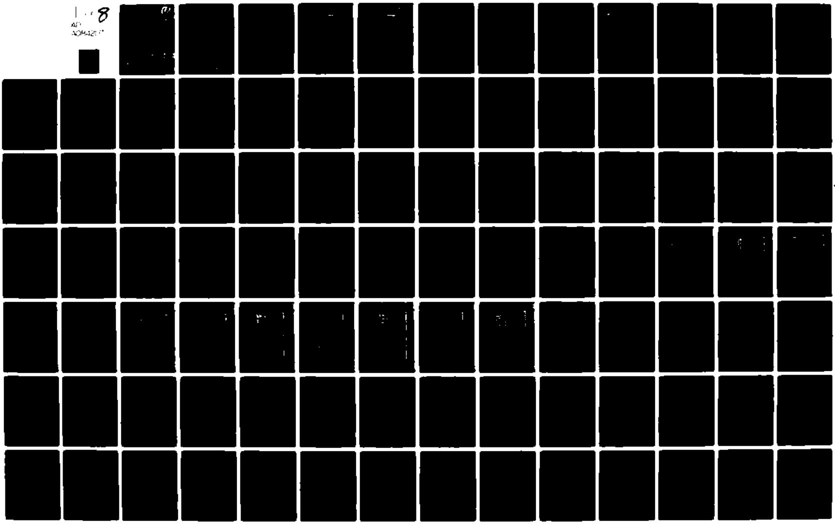

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FINAL SURVEY STUDY.

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GREAT LAKES and ST. LAWRENCE SEAWAY NAVIGATION SEASON EXTENSION.

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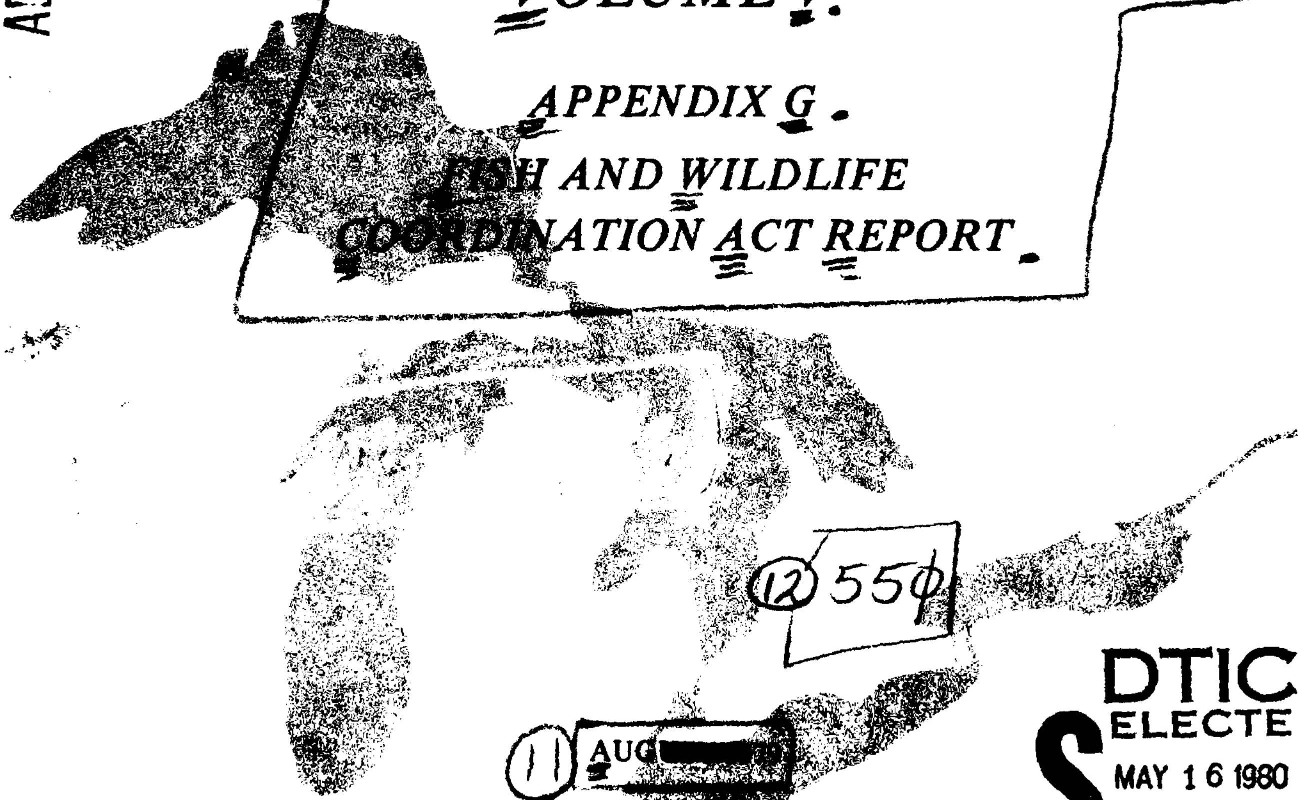
APPENDIX G.

FISH AND WILDLIFE COORDINATION ACT REPORT.



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This is the Final Report for the Great Lakes and St. Lawrence Seaway Navigation Season Extension feasibility study. The goal of this study is to consider the feasibility of means of extending the navigation season on the entire system from mid-December to early April (year-round). The report uses, as a base condition, the Chief of Engineers 16 November 1977 report which recommends the extension of the navigation season on the upper four Great Lakes to 31 January (± 2 weeks). The purpose of this study is to determine whether

Federal participation in Navigation Season Extension is desirable, and its extent, if any, to address the significant social, environmental, economic, engineering, and institutional aspects, and, to make a recommendation for Congressional consideration based on these findings.

This Final Report evaluates six proposals, considering various season lengths and geographic coverages, to further extend the navigation season on the entire Great Lakes/St. Lawrence Seaway System up to 12 months on the upper four Great Lakes, and up to 11 months on the Welland Canal, Lake Ontario and the International Section of the St. Lawrence River. This report relates U. S. costs to U. S. Benefits.

This study concludes that season extension is engineeringly and economically feasible year-round on the upper three Great Lakes, up to year-round on the St. Clair River-Lake St. Clair-Detroit River System and Lake Erie, and up to 10 months on Lake Ontario and the International Section of the St. Lawrence River. It is recognized that formal agreement with the Government of Canada is required for any extension on the system beyond the upper three Great Lakes. To assure and to confirm environmental and social feasibility of this program, an Environmental Plan of Action (EPOS) would be accomplished concurrently with implementation and execution of post-authorization planning, engineering, construction and operations with provisions to modify or stop the program if unacceptable environmental impacts surface. The District Engineer recommends that the project, as described above, be implemented.

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Volume	Title	[illegible]
I	Main Report and Final Environmental Impact Statement	
II	Problem Identification	A
	Formulation of Detailed Plans	B
III	Public Views and Responses on the Report and Environmental Impact Statement	C
IV	Economic Benefits and Costs	D
	GL/SLS Environmental Plan of Action	E
	Environmental	F
V	Fish and Wildlife Coordination Act Report	G
VI	Social Aspects of a Winter Navigation Program	H
	Levels and Flows	I
	Legal Considerations	J
	Demonstration Program Report	K
	Reference List, Glossary, and Abbreviations	L

GREAT LAKES and ST. LAWRENCE SEAWAY

NAVIGATION SEASON EXTENSION

APPENDIX

APPENDIX G FISH AND WILDLIFE COORDINATION ACT REPORT

AUGUST 1979

U.S. ARMY ENGINEER DISTRICT, DETROIT

CORPS OF ENGINEERS

DETROIT, MICHIGAN

APPENDIX G

FISH AND WILDLIFE
COORDINATION ACT REPORT

APPENDIX G

FISH AND WILDLIFE COORDINATION ACT REPORT

This appendix contains the U.S. Fish and Wildlife Service's Coordination Act Report in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.).

29 June 1979

APPENDIX G

INDEX

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

IN REPLY REFER TO:
LWR

JUN 29 1979

Colonel Melvyn D. Remus
District Engineer
U.S. Army Engineer District
Detroit
P.O. Box 1027
Detroit, MI 48231

Dear Colonel Remus:

This report is prepared in response to the U. S. Army Corps of Engineers' Survey Study of Great Lakes-St. Lawrence Seaway Navigation Season Extension. It evaluates the probable effects of winter navigation within the Great Lakes-St. Lawrence system on fish and wildlife resources and their utilization. The winter navigation season extension study began in 1970 and is divided into three parts: the insurance study, the demonstration study, and the survey (feasibility) study. The insurance study was completed in 1974. The demonstration study, after several extensions, is due to be completed in 1979. The survey study is to be completed in 1979. The Survey Study includes Canadian waters only within the connecting channels. Canadian participation has been limited to an observer role.

In this report, the Fish and Wildlife Service makes a number of recommendations, including the recommendation for a two-phase authorization approach for the Great Lakes portion of the system. This approach calls for (1) authorization and funding for project design and studies of fish and wildlife resources and project impacts to determine the environmental acceptability to be completed prior to (2) authorization and funding for construction and environmental monitoring. The Corps would suspend navigation season extension operations for three consecutive seasons during the first phase of study and design. We recommend this so pre-project baseline studies can be properly conducted without being invalidated by the passage of ships during the period they would not be passing without the project.

We also herein recommend that authorization not be sought or provided for construction of the Sandusky Bay, Ohio, and St. Lawrence River, New York, portions of the project.

The Corps established a multi-agency Winter Navigation Board to oversee the demonstration study. The Board is composed of representatives of Federal agencies actively involved with the study. The Board, in turn, organized and appointed a Working Committee and several sub-committees to oversee the various components of the demonstration. These groups have been functioning since 1971.

The function of the U.S. Fish and Wildlife Service in the Demonstration and Survey Study has been to collect existing baseline data and identify additional data needs for the impacted project areas; evaluate, under current knowledge, the perceived effects of the project; and provide a fish and wildlife report to accompany the survey report. In the demonstration, the Service has participated through the Environmental Evaluation Work Group. The Service was lead agency in the multi-state and Federal Environmental Planning Task Force that developed the Environmental Plan of Action (EPOA) discussed on page 15 and elsewhere in this report.

The Fish and Wildlife Coordination Act requires that the Service coordinate investigation of the project with the states involved. This state coordination includes the acquisition and exchange of data and state review and comment on the Draft Fish and Wildlife Coordination Act Report. Minnesota, Wisconsin, Illinois, Indiana, Michigan, Ohio, Pennsylvania and New York are the states involved. Comments we received from the states have been considered and resulted in textual changes in this report. Official comment letters are included in Section XIII of this Fish and Wildlife Coordination Act Report. Our full report is to be a part of the Corps of Engineers' final Survey Report to the Congress.

This report has been prepared under the authority of provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). The Great Lakes-St. Lawrence Seaway Navigation Season Extension Demonstration Program and the Survey Study were authorized by Section 107 of Public Law 91-611, the River and Harbors Act of 1970.

The intent of the Winter Navigation Program is to demonstrate that the whole seaway can be navigated beyond the normal closing time--about December 15. The seaway normally is closed between December 15 and March 15 due to weather and ice conditions. The areas dealt with in this study include the five Great Lakes, their principal bays, harbors, and connecting channels, and the international portion of the St. Lawrence River. The life of the project is to be 50 years. The base year for projections and economics is 1978.

This report provides the results of the U. S. Fish and Wildlife Service's coordinated investigations and evaluations. It presents recommendations to minimize or eliminate the adverse effects of the project on fish and wildlife resources. The recommendations, however, are by necessity very broad since the perceived adverse effects are based on very limited information on the fish and wildlife resource in the winter season and the lack of available time to do the appropriate baseline studies. It is presumed that pre-construction studies will provide the necessary information to determine the environmental feasibility of winter navigation in whole or in part, to compensate or mitigate for unavoidable fish and wildlife losses, and to enhance these resources where possible.

The report format selected makes for some redundancy and extra length. This should, however, enable those interested in only portions of the project to assess for the areas of their interest, the more detailed information in individual lakes, connecting channels, or harbors.

GREAT LAKES BASIN

The project area considered under the Navigation Season Extension Program is the Great Lakes System. The Great Lakes comprise the largest volume of fresh water in the world. This System, the five Great Lakes and their connecting waterways and canals, form a waterway 2,342 miles long from the middle of the North American continent to the sea. Of this, 1,270 miles are within the Great Lakes and the remainder is along the St. Lawrence River. This great volume of fresh water harbors a wealth of natural resources including a large conglomerate fish and wildlife resource.

A. Description of Area

The dimensions of the basin are approximately 700 miles in the north-south direction and 900 miles in the east-west direction. The Great Lakes within the basin, Superior, Michigan, Huron, Erie and Ontario, with their connecting rivers and Lake St. Clair, have a water surface area of about 95,000 square miles of which about 60,800 square miles are within United States boundaries. The total area of the Great Lakes Basin, both land and water, above the easterly end of Lake Ontario, is approximately 296,000 square miles of which 174,000 square miles are in the United States and 122,000 square miles are in Canada.

Climate

Temperatures are influenced by the Great Lakes due to water volume and surface area. This water volume (5,500 cubic miles) and surface area acts as a vast reservoir for the storage and exchange of heat energy with the atmosphere. This storage and exchange of heat energy significantly moderates the temperature regime of the adjacent land areas, as the annual water surface temperature range is half that of the air temperature, and lags behind the air temperature by up to three months.

This effect is pronounced during the winter when lake surface temperatures may be up to $30^{o}F$ warmer than mean air temperatures. This results in high winter lake evaporation. This moisture is carried over the land and results in areas of heavy snowfall downwind of each of the lakes. This effect is reduced when the lake surface becomes ice covered.

Precipitation

Precipitation is the source of most of the water for the Great Lakes. The number of days having measurable precipitation ranges from an average of 169 days east of Lake Ontario to 119 days at the southern end of Lake Michigan. Snowfall over the Great Lakes varies greatly from year to year and the amount of snow to be expected during a normal winter varies across the basin. Annual snowfalls of less than 20 inches are found to the south of the lower lakes, while annual snowfalls exceeding 140 inches occur in pockets east (downwind) and south of Lake Superior and east (downwind) of Lake Ontario. The St. Lawrence River area has an average annual snowfall of 80 inches. The amount of snowfall may vary up to 40 percent from the mean from year to year.

Winter Characteristics - Ice Conditions

In this climatic zone, where the period of freezing temperatures may not be long enough to cause a lake-wide ice sheet to form, the stages of ice formation and melting sometimes go on simultaneously at different points. The effects of winds, currents, and upwelling on the ice-cover cause rapid changes, making predictions of ice thickness and distribution difficult.

There are two general types of ice-cover formed on the Great Lakes: ice formed by the rapid freezing of surface water in the absence of wind and snow, called sheet ice; and ice made of fused individual ice pieces generally referred to as agglomeratic ice.

Agglomeratic ice usually contains ice of various ages combined with snow masses fused by new lake ice. It is formed when warm weather allows the breakup of thin, young sheet ice.

Ice-cover on the lakes first occurs in the sheltered bays and harbors and in a narrow fringe along the shoreline. The effects of winds, currents and upwelling upon the ice-cover causes it to change rapidly because long fetches across the lake surfaces allow the wind and wave forces to attain considerable strength. As the ice-cover moves and changes, it rafts and forms ridges that in some areas reach a height of 25 feet. Lake ice thickness normally varies from a few inches to 3 feet or more in protected areas.

Water Levels

The levels of the Great Lakes are a result of an integration of all of the hydrologic factors which affect the land and lake surfaces of the basin as well as the hydraulic characteristics of the connecting channels and the St. Lawrence River. Lake level frequency affects man's use of the waters, since it controls the shoreline use, navigation and influences hydroelectric power generation produced in the connecting channels and outlet rivers.

The levels of the Great Lakes are never constant. Short-term water level variations, called seiches, are caused by extended periods of winds and localized pressure changes. Long-term water level variations are caused by changes in lake water volume. Studies have been conducted to determine whether the long-term water level variations from high to low and vice versa follow a regular cycle. They show there is a regular seasonal rise and fall, with no evidence of regular long-term cycles.

Historically, winter ice jams have caused flooding problems and short-term variations in water levels. Ice jams generally are formed in connecting channels, rivers, and bays.

Water Quality

Many Federal, state, and local programs exist to maintain or enhance water quality in the Great Lakes Basin. The Federal programs are primarily the responsibility of the United States Environmental Protection Agency established by Reorganization Plan No. 3, effective December 2, 1970.

Interstate water quality standards have been adopted by all the states in the Great Lakes Basin. In addition to municipal and industrial wastewater control problems, other existing or potential problems involve wastes from watercraft; runoff from urban and rural land, including residues from the application of chemicals, fertilizers and pesticides; thermal pollution; and disposal of dredged material. The large concentrations of people and industry in the Great Lakes Basin, as well as the concentrations of agriculture in other areas of the Basin, have created complex water quality problems which require coordinated planning for their solution. The Federal, state, and local efforts to remedy existing water pollution problems and prevent future water quality degradation vary within lake and river basins, because of varying situations and varying availability of required resources and technology.

As the growth of population and industry creates additional pressures on water supply and quality for established uses, further emphasis will have to be placed on identifying areas that require advanced waste treatment. In addition to waste treatment problems faced by municipalities and industries, other problems will require continued attention and greater resources for their solution. Examples of such problems are soil erosion and sedimentation, combined sewer overflows, thermal discharges, wastes from watercraft, oil pollution, organic contaminants, and dredged material. The non-point pollution problem should receive increased attention in many river basins. Technology, and construction measures can provide a partial solution to this problem.

Human Environment and Resources

The single most significant resource is the five Great Lakes and connecting channels. This source of water in addition to abundant natural resources and large agricultural potential, has allowed a highly industrial and agricultural area to develop. Most of the urban, industrial, and agricultural areas are confined to the southern half of the basin. The United States portion of the basin contains one-seventh of the Nation's population on 4 percent of its surface area and produces one-sixth of the national income. Within the Canadian portion of the basin, the importance is even greater. The Ontario portion alone contains almost one-third of the total population of Canada and produces nearly one-third of the national income. If the Canadian portion of the St. Lawrence River Basin is included, then the proportion of total population and economic activity rises to over 60 percent of the Canadian national total.

Employment

Employment trends for the eight states bordering the five Great Lakes have paralleled national employment shifts for most major employment sectors during the period 1940-1970. In 1970, nearly 4 million persons were employed in manufacturing, about 35 percent of the total persons employed. The major manufacturing industry group employers are primary metals, food and kindred products. Agriculture accounted for about 4.4 percent of the Basin's employment in 1970, and mining accounted for another 0.8 percent.

Production

The Great Lakes Basin economy is basically industrial, utilizing the transportation and power advantages offered by the Great Lakes-St. Lawrence River system. In addition, there is significant agricultural, mining and forestry production. Fishing, historically one of the oldest activities, has declined in commercial importance.

The region is the primary focus of the iron and steel industry in North America, accounting for 40 percent of the United States production and 80 percent of the Canadian output. The Great Lakes ports serve an additional one-third of the United States Steel industry. The region also contains high proportions of other industries, including chemicals, paper, food products, machinery, transportation equipment and fabricated metal products. Mineral production is also important, particularly iron ore and limestone.

Transportation

The region occupies a location strategic to the highly-industrialized and well-populated north-central United States and south-central Canada, and is astride the transcontinental link between the major agricultural production regions of the west and midwest and the consuming areas of the east. All modes of transportation have major terminals on the Great Lakes. In many cases, these terminals act as transfer points from one mode to another.

Recreation

The Great Lakes Basin has 14.5 million acres of public recreation areas. There is a great diversity of outstanding natural features such as forests, meadows, marshes, shorelines, islands, streams and lakes (both Great Lakes and inland). Many of these areas have exceptional scenic, wilderness, and aesthetic qualities which make them nationally significant. Recreational resources are not evenly distributed, being mostly located in the drainages of Lake Superior, Lake Ontario, and the northern parts of Lakes Michigan and Huron. Tourism reflects this uneven distribution, with most of the popular tourist areas being found in these areas.

As of 1970, there were 885,000 acres in national parks, wildlife refuges, and wilderness areas and over 554,000 acres of state and local parks. Much of the remainder is in Federal and state forests. The 1970 estimate of 637.1 million recreational days is expected to increase to 861.3 million user days by 1980 and to 1,863.6 million days by the year 2020. The above figures do not include the man-days spent for fishing and wildlife resource based activities.

In general, the sport fisheries and wildlife resources are major attractions which provide for a high-value industry. The basin sustained over 81 million man-days of sport fishing in 1970 with over 16 million man-days on the Great Lakes themselves. The birds and animals of the basin annually support over 24 million man-days of hunting.

B. Description of Project

The survey study first considered three alternatives for winter navigation. The "no action" alternative is described as navigation as it was before the Demonstration phase began. This includes traditional winter closing of the locks and the taking in of the navigational aids. The second alternative is winter navigation under specified closing times. Navigation would be terminated and initiated on specific dates. The third alternative considered was all-year navigation. The Corps of Engineers' recommended alternative, combines the second and third alternatives. Portions of the system are proposed to be open all year and other portions would be open for eleven months.

In the view of the Fish and Wildlife Service, the "no action" alternative would be the least damaging to fish and wildlife resources. The Corps of Engineers' recommended alternative would have adverse effects on fish and wildlife resources and we have so stated in our report dated February 1976 that accompanied the Interim Survey Report of the Corps.

This section presents a general description of the various elements and improvements which are considered necessary to achieve the study proposed plan--year-round navigation on the upper four Great Lakes and 11-month navigation through the Welland Canal-Lake Ontario-St. Lawrence portion of the system. The following sections present more detailed descriptions of the proposed elements.

Proposed operational measures considered for implementation and necessary for extended season operation on the entire Great Lakes-St. Lawrence Seaway system are:

Lakes - Connecting Channels - St. Lawrence River

Icebreaking
Icebreaking Mooring Improvements
Vessel Traffic Control
Ice/Weather Data Collection/Dissemination Systems
Aids to Navigation
Ice Control Structures
Air Bubbler Systems
Lock Modifications
Power Plant Protection
Dredging
Compensating Works
Shoreline Protection
Island Transportation Assistance
Connecting Channel Operational Plans
Water Level Monitoring
Vessel Speed Control and Enforcement
Safety/Survival Requirements
Vessel Operating and Design Criteria
Search and Rescue Requirements
Oil/Hazardous Substance Contingency Plans
Vessel Waste Discharge (non-human) Requirements
Environmental Plan of Action
Pilot Access
Channel Clearing Craft

Harbors

Icebreaking
Ice Control Structures
Air Bubbler Systems
Aids to Navigation

Costs

Costs for the study proposed plan are based on February 1978 prices and include United States costs only. In deriving the United States costs on the St. Lawrence River, an assumption is made that the United States would pay for 100% of all improvements within the United States territorial boundaries of the St. Lawrence River, as well as 50% of the total cost of facilities on the international section of the river. Conversely, it is assumed that Canada would pay for 100% of all improvements within its own territorial boundaries of the St. Lawrence River as well as 50% of the total cost of facilities on the international section of the river. It should be noted that this United States/ Canada cost split on the St. Lawrence River is an initial assumption and is subject to negotiations between the United States and Canadian governments.

Phased Implementation

Although this study is being pursued with the objective of achieving a Single-Phase Construction Authorization for the entire Great Lakes-St. Lawrence Seaway System, it is currently planned that the project would be implemented in phases due to current constraints such as an active co-participation agreement with the Canadian Government. A selected series of phases has not been defined yet; however, several alternative phases are being evaluated. The alternative phases are:

Period of Extension

Alternative Phase	Lake Superior St. Marys River Lake Michigan Straits of Mackinac Lake Huron	St. Clair River Lake St. Clair Detroit River Lake Erie	Welland Canal Lake Ontario St. Lawrence River
1	Year-round	1 Apr - 31 Jan[1]	1 Apr - 1 Dec
2	Year-round	1 Apr - 31 Jan[1]	1 Apr - 31 Dec[2]
3	Year-round	Year-round	1 Apr - 15 Dec
4	Year-round	Year-round	1 Apr - 31 Dec[2]
5	Year-round	Year-round	15 Mar - 31 Dec[2]
6	Year-round	Year-round	15 Mar[2] - 15 Jan
7[3]	Year-round	Year-round	15 Mar[2] - 15 Feb

(1) Based on March 1976 Interim Feasibility Report recommending extended season navigation on the upper four Great Lakes to 31 January ($\pm$ 2 weeks) using only existing operational measures.

(2) This time extension is consistent with the current Canadian plan to extend navigation season on the St. Lawrence River. It is being implemented in three phases: firming up the present season by providing improvements to ensure 24-hour/day navigation from 1 April to 15 December, extending the season closing date to 31 December, and advancing the season opening date from 1 April to 15 March.

(3) This is the overall study proposed plan.

An environmental study would be done during the first 10-15 years of the advanced engineering and design, construction and operation phases of the project. This study would be designed to provide a programmatic approach for determining the environmental feasibility of an extended navigation season program, and to provide assurance that winter navigation would be conducted in an environmentally acceptable manner, with provisions made for accomplishing any necessary compensation and mitigative actions.

To implement the project, should it be authorized, consideration is being given to proposing a review organization of those agencies that would be responsible for implementing the program to insure that implementation be a coordinated effort. Currently, the organization would relate to three primary functions: construction/operations, engineering/planning, and environmental.

C. Fish

1. Without the Project

The Great Lakes Basin contains more than 230 species and subspecies of fish representing most of the freshwater fish families in North America. This diversity of fish fauna indicates that a wide range of habitats are present in the Basin. Most of these fish are indigenous, but man has introduced some species that have profound influence on the fisheries of the Basin. Man also has degraded the fisheries through harmful development, pollution, and over-utilization. The various states have management responsibility for the fishery resources in the Basin.
The Service is responsible for the protection of endangered species. The only Federally endangered fish known to occur in the Great Lakes system is the long-jawed cisco.

Commercial Fish

Commercial fishing in the Great Lakes has been important for over a century. Near the end of the 19th Century, the commercial fishery was flourishing and harvests of the traditional high-value food fishes were large. These fishes included lake trout, lake sturgeon, lake whitefish, lake herring, walleye, blue pike, sauger, and yellow perch (Table 1). The total harvest peaked in 1915 at nearly 150 million pounds. Harvest has declined since then to as low as 87 million pounds in 1942 and 1959. Table 1 also shows that the United States catch declined while the Canadian catch has steadily increased.

The commercial harvest has radically changed in composition as well as tonnage. Now, the catch composition, as shown in Table 2, has changed to the less desirable species. These include alewife, carp, smelt, and chub, with the alewife catch amounting to over half of the total catch. There has been an even greater decrease in commercial fishermen and fishing vessels, indicating a change of fishing gear and an increase in efficiency as well as the decline in catch.

Man's developments, including navigation, industrial, and urban developments, have reduced fish habitats in many segments of the Basin. The southern half of the Basin has experienced most of the habitat losses from this cause. The southern part of Lake Michigan is an example. Portions of that area, from Chicago to St. Joseph, Michigan, contained extensive marsh, sand dune, beach and aquatic habitats. As this area became industrialized and urbanized, the fish and wildlife habitats were destroyed until those wetlands, beaches and dunes remaining include only those remnants in the Lake Calumet area, the Burns Ditch Area and those wetlands, beaches and dunes protected in the Indiana Dunes National Seashore. The aquatic habitats have been displaced and degraded by dredging and filling for navigation, recreational boat marinas, industry, and urban development. The wetlands, as well as the aquatic habitats, were heavily used by commercially important species such as yellow perch and walleye.

Man's introduction of fish species into the Great Lakes Basin has been both beneficial and harmful. The Welland Canal permitted sea lamprey, alewife, and smelt to enter the upper lakes. This introduction had catastrophic results on the commercial fishery. Steelhead (Pacific Coast rainbow trout), Pacific salmon, and Atlantic salmon, were introduced to benefit the commercial and sport fishery and to prey on the alewife.

TABLE I

GREAT LAKES COMMERCIAL FISH CATCH
(1879 - 1970)
(thousand of pounds)

Year	Total		
	United States	Canada	United States and Canada
1879	66,891	9,347	76,238
1885	97,623	23,668	121,290
1889	115,575	28,362	143,937
1890	111,550	28,646	140,196
1893	107,582	26,629	134,211
1897	94,930	20,541	115,470
1899	119,424	26,107	145,530
1903	94,185	18,839	113,024
1908	113,315	24,473	137,789
1914	103,407	31,731	135,138
1915	111,587	38,279	149,865
1916	89,085	32,900	121,987
1917	97,439	37,798	135,237
1918	106,181	39,187	145,367
1919	85,400	30,546	115,947
1920	73,168	31,680	104,848
1921	87,741	29,883	117,625
1922	81,107	32,020	113,127
1923	78,285	34,148	112,433
1924	77,969	34,492	112,461
1925	73,586	26,466	100,050
1926	73,182	24,718	97,900
1927	79,508	27,847	107,354
1928	62,027	27,015	89,040
1929	71,174	27,216	98,388
1930	87,412	28,354	115,765
1931	87,341	27,092	114,431
1932	79,370	24,945	104,313
1933	70,751	23,703	94,454
1934	90,880	25,269	116,149
1935	87,011	29,132	116,143
1936	90,570	27,794	118,363
1937	81,001	30,098	111,099
1938	79,299	28,929	108,228
1939	82,720	27,509	110,229
1940	76,588	21,770	98,358
1941	76,429	20,935	97,365
1942	68,261	19,206	87,466
1943	81,968	23,140	105,108
1944	83,483	27,660	111,144
1945	68,906	26,502	95,408
1946	68,623	24,147	92,771
1947	79,663	30,353	110,017
1948	75,525	36,949	112,473
1949	79,748	39,866	119,614
1950	75,207	38,572	113,778
1951	78,948	52,218	131,165
1952	74,041	43,743	117,783
1953	68,897	38,405	107,303
1954	63,464	40,098	103,562
1955	65,936	37,918	103,854
1956	67,140	45,368	112,508
1957	61,850	58,534	115,384
1958	55,823	42,794	98,617
1959	53,559	34,045	87,604
1960	54,156	43,579	97,735
1961	67,726	47,813	115,539
1962	81,956	44,836	126,792
1963	67,324	47,219	114,543
1964	66,969	55,579	122,548
1965	70,390	40,167	110,557
1966	62,824	38,106	100,930
1967	58,428	38,782	97,210
1968	66,657	47,886	114,543
1969	76,990	47,854	124,844
1970	60,657	40,429	101,086

Table 2

U.S. GREAT LAKES CATCH BY SPECIES

1975

Species	Pounds	Value
Alewife	35,215,800	$ 407,644
Carp	6,732,400	381,065
Whitefish	4,517,000	3,300,957
Yellow Perch	3,035,600	1,611,472
Smelt	2,573,300	138,726
Chubs	2,444,100	1,628,641
White Bass	1,699,500	490,872
Catfish	559,900	259,162
Lake Herring	513,400	145,939
Lake Trout	456,400	267,300
Other	2,909,400	418,514 1/
TOTAL	60,656,800	$9,050,292

1/ No individual species valued at over $100,000.

About the time that the sea lamprey was decimating fish stocks in Lake Michigan-Huron, another of man's developments had a substantial impact on the Great Lakes fishery--the nylon gill net. This net increased the efficiency of the fishermen and also was partially responsible for the collapse of the fishery through over-fishing. Many of the commercially important food fishes take a relatively long time to reach sexual maturity. For this reason, over-fishing can occur without strict management.

In the last 25 years, fierce competition has developed over the remaining and developing fish stock among recreational, commercial, and Indian fishermen. The states responsible for fishery management have restricted commercial fishing to favor the more lucrative sport fishing.

Most commercial fishing has occurred during the ice-free months on the Great Lakes. Weather has always been a major factor for the fishermen--they cannot fish during storms and high winds. However, there are small amounts of yellow perch and other species taken commercially by seining and gill netting in winter. Green Bay, Saginaw Bay, Whitefish Bay, St. Lawrence River, and some other areas where thick ice generally forms are the main areas where winter commercial fishing occurs.

The number of commercial fishermen and commercial harvests are not likely to increase in the near future. Commercial fishing depends heavily on the states' willingness to allocate fish to them. The state and Federal governments are stocking the lakes with millions of fish annually. However, reproduction has not met expectations so only a limited commercial harvest is allowed. The commercial fishermen have been reluctant to use the underutilized species because of their low value. It appears that the Great Lakes commercial fishery depends in large part on the various states' management policies.

Sport Fish

Sport fishing in the Great Lakes is as varied as the species taken. Nearly all sport fishing is high value because of the location, boats, and gear used. The colder waters of the upper lakes contain lake trout, brook trout, rainbow, brown trout, coho salmon, chinook salmon, as well as some whitefish. Atlantic salmon have been stocked in some portions of the lakes, but do not contribute significantly to the fisheries yet. The remaining portions of the Great Lakes contain some of the salmonids, but mostly have the cool water and warm water species, such as walleye, northern pike, yellow perch, smallmouth bass, largemouth bass, white bass, muskellunge, sauger, catfish, bullheads, crappies, sunfish, carp, suckers and redhorse, freshwater drum, smelt, and white perch. The lakes produce large amounts of plants,

fish and other biota which these species depend on for cover and food. The whole range of species is sometimes called the food chain or web of life. Each link is important.

Historically, sport fishing has probably occurred on the Great Lakes since man first appeared on its shores. The Indians used the lake fish for their food supply and for recreation. The white man first used the fish for food. As the population increased, commercial fishing developed. Large resorts were built to accommodate the fishermen. The supply of high quality fish seemed limitless. The gear and boats of sport and commercial fishermen went through an evolutionary process which made catching fish more efficient. When the commercial fishery collapsed after World War II, sport fishing also declined in nearly all portions of the Basin. During the last 25 years, there has been a resurgence in the demand for sport fishing on the Great Lakes.

Ice fishing on the Great Lakes comprises an important, though small part of the total fishing pressure. Because of the general instability of ice cover on the main part of the big lakes, this fishing takes place on the bays, connecting channels, smaller connected lakes, and around the nearshore islands. A few of the more hardy and venturesome fishermen do go offshore some distance to fish for lake trout through the ice. Other species caught through the ice include walleye, yellow perch, northern pike, crappies, sunfish, white perch, white bass, rainbow trout, brown trout, whitefish, and salmon. Most ice fishermen are local people though some of the popular areas draw fishermen from greater distances. Presently, there are no system-wide estimates on ice fishing activity. There are some local estimates where ice fishing man-days may be as many as summer fishing.

The future of sport and commercial fishing is dependent on state fishery management. This finite resource can bear only a certain amount of fishing pressure and still be managed on a sustained-yield basis. This amount is currently unknown, but does depend on many variables.

2. With the Project

The project will cause fish resource and habitat losses in the Great Lakes Basin. The previous sections state that important biological data in some areas is not available. Because of this missing data, the project impacts cannot be evaluated with great certainty or accuracy. The Fish and Wildlife Service can express concerns and give a probable evaluation of the impacts in these cases. The proposed environmental studies in the EPOA are being designed to obtain the missing data, determine the environmental feasibility of winter navigation in whole or in part, identify and monitor project effects, and prepare a report which will recommend the means and measures to eliminate or minimize adverse effects and enhance the resource where possible.

The following paragraphs and subsections will present Service concerns and observations of effects of the project on the fish and wildlife resources and their habitats. These paragraphs and subsections will present the basin-wide effects and possible means and measures to reduce or eliminate the foreseen adverse effects. Later sections will present more detailed information, discussions and recommendations.

The following with-the-project discussions will consider the project developments that will be needed for all year navigation on the upper four lakes with 11-month navigation on the Welland Canal, Lake Ontario, and the St. Lawrence River. Though the Service prefers the "no action" alternative, the recommended plan will be evaluated.

The following list presents the proposed development and the probable impact it will have on fish and fish habitat in the Basin.

Icebreaking

The Coast Guard will be responsible for icebreaking throughout the Basin except where non-Federal icebreaking tugs are proposed to operate in 18 harbor areas. There will be adverse impacts associated with the icebreaking. Icebreaker propeller thrust in some cases and their repeated resuspension will degrade water quality. Propeller thrusts also create unnatural water currents that can transport the sediment into areas not previously receiving them. Resuspended sediment can cover and smother over-wintering fish eggs and benthic organisms which are needed as fish food. The covering of fish eggs and fish food could cause fish mortality as the fish and eggs are in a naturally stressful situation in winter. Icebreaking also may create open water areas that were previously ice covered. This could change the natural regime of the ecosystem by allowing oxygen and light to penetrate the open area. The loose ice generated by icebreaking could drift downstream in the connecting channels forming ice jams and dams. This could raise water and ice cover levels. In so doing, rooted aquatic plants may be uprooted and removed. Icebreaking also forces the broken ice under the edge of the stable ice. This causes rampart-like walls to form along the track. These walls may become deep enough to touch bottom. They would displace significant amounts of the cross-sectional volume in some areas and possibly affect winter movement of fish or cut off access to near-shore spawning areas. Then, when large vessels pass, at high speeds, severe resultant wave surges could destroy large amounts of fish and their habitats. During spring breakup these ramparts, caused by icebreaking and cargo vessels, could scrape the bottom and scour benthic habitat and fish spawning habitat as well as resuspend bottom sediments.

Icebreaker Mooring Facilities

These facilities are also under Coast Guard planning and implementation (see specific harbor sections in the Fish and Wildlife Coordination Act Report and current Corps of Engineers Survey Study for the selected harbors).

Depending upon location, icebreaker mooring improvements could cause environmental damages, particularly if located in, or adjacent to, existing wetlands. Some designated harbors have known or suspected fish spawning sites containing overwintering eggs. Propeller wash from icebreakers could cause severe losses of these eggs through sedimentation. Many of the harbors have polluted bottom sediments and the dredging of access channels for the icebreakers could resuspend these pollutants. Dredged spoil placement also will be a problem. Environmental studies and assessments for each specific site for icebreaker mooring facilities will be required to help develop ways to minimize or eliminate possible damages.

The Fish and Wildlife Service believes that the icebreaker mooring facilities proposed for Traverse City, Michigan, should be changed to Charlevois, Michigan, or some other mutually acceptable harbor to prevent environmental damages to the aquatic resources of Traverse Bay.

Vessel Traffic Control

This development is presently operational in various parts of the Great Lakes system. While vessel traffic control does not, in and of itself, directly affect fish resources or their habitats, its use with appropriate modifications could be useful in reducing other adverse effects. For example, the development of a traffic control plan regulating simultaneous two-way traffic in narrow portions of the St. Marys River could eliminate the need for dredging in the Middle Neebish Channel. The traffic control plan could include traffic control lights which would direct one of the vessels to pull into a designed side parking area provided midway in the Neebish Channel while allowing the other vessel to pass.

Ice/Weather Data Collection/Dissemination Systems

This development would not affect fish and wildlife resources or their habitats.

Aids to Navigation

This development includes the installation of all-weather fixed lights and radar reflectors. These will be set on structures at various channel turns and in harbors. These structures will be set on islands, on shore, and on other permanent structures. There will be no adverse effects on fish or their habitats since they will be placed on land or on other structures.

Ice Control Structures

Ice booms and ice anchoring islands or structures make up these developments. These would be located throughout the system, primarily in the connecting rivers and at harbor entrances. Ice booms are floating logs or tanks, chained together and anchored in place. The anchors would displace a small proportion of bottom when they are placed. Generally, these anchors would be left in place. The booms are removed in spring, then reattached in the fall. Thus, the bottom habitat would rehabilitate around the anchor sites with a small disturbance when the booms are reattached. Ice booms hold back and stabilize the ice cover which restricts flows because of the friction between it and the water beneath. This will have an affect on water levels both upstream and downstream from the structure. Water levels will tend to rise upstream and fall downstream. However, just the opposite would occur with the St. Clair-Detroit River ice booms because they eliminate the naturally formed ice jams which hold back more water flow. Water level changes would affect marshes and other habitats by unnatural sequencing of water level functions.

The ice anchoring islands would displace bottom habitat. If the islands were constructed of rubble and large stone as proposed, it is likely they could be beneficial to fish as cover and feeding area. Other factors would have to be considered as well to determine their worth as habitat. The islands would have to rise above the water surface. Shorebirds and waterfowl might use these for resting habitat and possibly nesting.

Air Bubbler Systems

The bubblers proposed would use relatively low air pressure -- only enough pressure to melt some of the ice. They would be used in some harbors, along docks and along channels. Bubblers would be used where tight turns exist, in channels, and in the connecting channels. If low air pressures are used, bubblers will not have severe effects on water quality or the bottom and benthos. It is not known whether the bubblers, if operated continuously, will keep the area above them open once the ice is broken. Likewise, spacing between the jets and jet pressure

could be significant because the bubbler could act as an air curtain inhibiting fish movement. Considering all factors, we do not anticipate that these bubblers would have significant adverse effects on fish resources or their habitats.

Lock Modifications

The proposed lock modifications are minor in nature. These include the use of steam and mechanical means of removing ice from the structures. Other modifications include bubbler flushers in the upstream approach to keep ice away from the gates, a coating on lock walls to inhibit ice buildup and dredging at the lip of the downstream approaches where some increased accumulations of coarse gravel and rocks will occur. There is a proposal also for floating equipment to maintain the locks in winter. This would require the modification of existing equipment. Fish do pass through the locks -- this is how sea lamprey are thought to have entered the upper part of the system -- but the main times for fish movement is during spring and fall, not winter.

Power Plant Protection

This proposed development consists of floodproofing the Edison-Sault Power Plant at Sault Ste. Marie. These developments are confined to the structure itself. There will be no effects on the fishery resources or their habitats.

Dredging

Dredging is proposed for the St. Marys and St. Lawrence Rivers. In the St. Marys, dredging would be done to widen the Middle Neebish navigation channel to accommodate two-way traffic. In the St. Lawrence, dredging is proposed to reduce the current velocity in certain reaches. Dredging is also proposed in some harbors to develop and provide access to the deep-draft icebreaker mooring facilities. Dredging in the St. Marys and St. Lawrence Rivers would eliminate bottom habitat with its benthos, and the dredging might result in lower water levels in the vicinity and upstream. This would reduce the amount of wetland available for fish and wildlife resources. Thus, fish resources and their habitat will be eliminated. The spoil disposal could also have an adverse effect on fish resources. The development and implementation of a traffic control system consisting of traffic lights and a parking area in the middle Neebish Channel would nearly eliminate the need for dredging and spoil disposal. The only exception would be in the construction of a parking area midway in the Middle Channel which would allow ships to pass each other. This would minimize the direct environmental impact of dredging

and spoil disposal and would confine disturbances from vessel movement to a smaller area. The Corps has not proposed a disposal site for dredged material from the St. Lawrence. The spoil from dredging the access channels for the icebreakers may be polluted, thus requiring special handling. Disposal sites for this spoil have not been identified. If this spoil is placed in the waters of the system, it could have very harmful effects on the fish resources. More information is needed to determine where the spoil is to be placed and what the effects of that placement would be.

Compensating Works

Compensating works are being proposed in the St. Clair and Detroit Rivers to compensate for the effects on the flows in the rivers from the ice boom at the head of the St. Clair and Detroit Rivers. These works will be gated partial regulating mechanisms to control water levels in Lakes Huron and Erie. The areas where compensating works would be constructed are used as feeding and spawning areas by various important fish species. If the compensating works eliminate all downstream water level fluctuations, downstream wetlands would be degraded since they depend upon short-term water level fluctuations to remain dynamic. To protect the wetlands, water levels must be maintained in a manner that follows naturally occurring short-term rises and falls. Another potential problem is the change in current patterns in the downstream reaches. In the St. Clair-Detroit River System the river bottoms are polluted in areas. If current patterns change, polluted sediments could be resuspended, thus adversely affecting fish and wildlife resources. In addition, changing current patterns could eliminate currents needed to aerate eggs and bottom organisms. Too much current in other areas could sweep fish eggs and benthos away or cover them with silt and debris.

There is a lack of baseline information and data regarding the areas which will be affected by the compensating works. If physical and biological baseline studies are performed it may be possible to predict and evaluate adverse impacts and possibly to correct for them. There are many other questions to be answered concerning the compensating works and their effects on fish and wildlife resources and their habitats. Further detailed discussion will appear in the portion of the report on the St. Clair and Detroit Rivers.

Shoreline Protection

This development is being proposed for specific areas where determined necessary by an ongoing study. More detailed discussion of this will appear in the appropriate sections. The impact of this proposal varies, depending on fish and wildlife species present at the work location. Impacts will vary from beneficial to adverse for fish and wildlife resources. There is a significant potential for shoreline and shore structure damage by vessel movement and icebreaking associated with an extended navigation season. A study should be conducted to delineate damage-prone areas utilized by fish and wildlife resources. Structures to protect the shoreline and other structures could adversely impact fish and wildlife resources and their habitat in some instances. Damages could include wetland changes brought about by riprapping and attendant reduced water circulation. Bottom erosion can also be serious. Physical and biological baseline data and information for the potential shoreline erosion and structure damage areas are lacking. The areas thus far identified are in the connecting channels.

One mechanism causing erosion and shore structure damage is the pressure waves induced by ship passage. The pressure wave is caused by the passing ship's displacement of water in a rather confined cross-sectional area so that the ratio between displacement and cross-sectional volume is high. The forces in the pressure wave generated become greater as the speed and displacement of the vessel increases. Water velocities are greatly accelerated and fish in the affected area cannot fight the currents and are tumbled about. Repeated exposure to this phenomenon may kill fish, especially since they are naturally stressed during the winter. Bottom erosion is very high in these areas and benthic habitat has been eliminated. This destruction of fish habitat and repeated mechanical stressing of fish is probably more detrimental to fish populations than the direct mortality that has been observed to occur as a result of surge waves. Severe environmental damages have occurred in some areas. Presently there is inadequate vessel speed control to keep these damages from occurring.

Island Transportation Assistance

This development is proposed for the St. Marys River. It consists of installing ice booms and a bubbler-flusher at a ferry dock; moving a sewer outfall, and constructing and operating an ice boat. The ice booms and moving the sewer outfall are discussed in the section on ice control structures. The studies on the other areas where island transportation occurs indicated

that there were no other needs in the basin. The impacts of these developments on the fish and wildlife resources of the St. Marys River are discussed in detail in Section V of this report. The impacts of lower water quality from the relocation of the sewer outfall on fishery resources may be significant. The effect of the ice booms may be insignificant, particularly if the anchors are left in place. The bubbler-flusher at the mainland ferry dock also should be insignificant due to its small size. The ice stabilization islands may displace some habitat for some species, but it could create habitat for others.

Connecting Channel Operational Plan

This pertains to island transportation of the previous section. The main feature proposed is icebreaker assistance on an as-needed basis at the various ferry crossings. This could affect fish and wildlife and their habitats in the ferry track because of propeller wash. These impacts are discussed in detail in Section V.

Water Level Monitoring

Stream gages would be installed in the waters of the connecting channels. These devices must to be set over the water so locations would include existing permanent piers or other permanent structures to be constructed. A small structure to house the gage also is needed. The effects of these structures on fish and wildlife and their habitats would be minor.

Vessel Speed Control and Enforcement

The Coast Guard, the responsible Federal agency, has concluded that the present speed limits in the basin are being enforced. However, the Fish and Wildlife Service has found that fish and wildlife and their habitats are being lost because of vessel passage and the speeds at which the ships pass. In certain areas throughout the basin, where the displacement of a ship is a significant part of the channel volume and there are adjacent shallow areas, lost habitat can be expected on a routine basis. Both Service and Corps of Engineers Cold Regions Research Engineering Laboratory (CRREL) personnel have witnessed the effects of this phenomenon on the St. Marys River and CRREL has made a study of it in connection with their shore erosion studies. The currents generated in a pressure wave are manifested in water current under the ice. These current velocities are accelerated across the shallow areas at a rate in geometric proportion to increasing vessel speed. Fish cannot swim against these currents and are tumbled about. In addition to direct fish mortality, the river bottom (fish habitat), aquatic vegetation beds, and the benthic community (fish food), also are destroyed causing

a reduction in fish-carrying capacity of the area. Nearly all of the areas where fishes and their habitat are affected coincide with areas identified as receiving shore erosion and shore structure damage. These impacts are further addressed in the various sections of this report dealing with specific sites where pressure waves are thought to occur.

Safety/Survival Requirements

The development would not affect the fishery and wildlife resources.

Vessel Operating and Design Criteria

Presently there are ships operating in the system which do not have the modifications recommended in the existing operating and design criteria. For vessels operating in ice, the criteria are explicit about hull strength, power plant size, strengthened steering mechanisms, special propellers and other special gear. There are also special criteria for oil and hazardous substance transporters. Fish and their habitats as well as humans are imperiled because ships do and will continue to operate unmodified. The risk of an accident involving these ships would probably be greater. Strict enforcement of a requirement to modify the ships regularly using the Great Lakes in winter would reduce the probability of accident and consequently spills. However, no additional regulations or enforcement are proposed in the plan.

Search and Rescue Requirements

This would not affect the fish and wildlife resources.

Oil/Hazardous Substance Contingency Plans

The lack of compliance with the operating and design criteria causes the probability of a spill to increase. The existing spill contingency plan is untried in winter. Several of the described contingency plan segments do not adequately protect the fish resources from a spill. We have several concerns about the contingency plans. First is task force or team response time, i.e., the length of time it takes for the containment and cleanup personnel to get to the site. Second is containment equipment response time, i.e., the length of time for proper equipment to arrive at the site and become operational. Third is the inability of the equipment to completely contain and clean up spills, especially in winter and in flowing or turbulent water. The response time for the National Strike Team to arrive anywhere on the Great Lakes is too long. National Strike Force personnel

have a 4-hour response time to arrive at an airport that can handle a C-130 cargo aircraft near a Great Lakes spill site. Regional teams could be on site in somewhat less time, and local teams could be on site in about the same time as the Regional teams. These teams would assess the situation and call for equipment which may take several hours to become operational. Some equipment might take as long as a week to be on site. We understand that under winter conditions, containment and cleanup equipment is inefficient. Under these circumstances, an oil spill could be catastrophic in its effects on fish and wildlife resources and their habitats. The flowing waters of the connecting channels, open lake spawning and nursery areas, open lake and flowing water food supplies, and the aquatic and emergent vegetation sites would be areas most vulnerable to damage by spills. Damages to these areas would depend to a large extent upon the nature and amount of the substance spilled. Oil or light distillate spills could travel a long distance downstream in the flowing waters of the connecting channels. In open waters, a spill could travel a long distance downwind during a storm on the lakes. The containment booms have not performed satisfactorily, even under more ideal conditions than found in winter. Response time for the regional teams also is too long. By the time cleanup equipment is on the site, much of the spill can escape the booms and spread to an even larger area. Hazardous materials or toxic substances which cannot be recovered by conventional techniques are special problems to fish. Spills of these materials can have toxic and chronic effects and affect dissolved oxygen levels if they possess a high biochemical oxygen demand. Fish can come in contact with the oil and fish habitat can be damaged. Overwintering fish eggs, if present, could be destroyed and spawning habitat made unusable. A spill also could destroy the benthos inhabiting an area if the material sinks. The benthos are an important food source for many fishes. The probability of a spill should be reduced as much as possible and if a spill occurs, the containment and cleanup should be accomplished as soon as possible to keep damages to a minimum.

Three types of studies are needed. The first, the study of the contingency plans to find ways to shorten response time of personnel and equipment, is underway on a limited basis for the Lake Erie area. This type of study should be conducted systemwide because of variations between regional and local contingency plans. The second study would be designed to find more efficient equipment to contain and remove spilled substances. This study should include investigating more strategic locations for storing equipment. The third study would entail investigating the effects of spills after they have occurred. Provisions should be made to fund monitoring studies of longer duration.

Vessel Waste Discharge (non-human) Requirements

These requirements and standards have been set and enforced by EPA. These requirements include the equivalent of secondary treatment. No wastes are to be discharged into the waters of the basin. The problems of disposing of these wastes are being studied and recommendations will be forthcoming. Fish and wildlife resources would be affected in a minor way, if at all, at the present level of enforcement. If the requirements and standards were strictly enforced, fish and wildlife would not be affected at all.

Environmental Plan of Action

There is much information concerning the fish resources of the basin needed to make more detailed and accurate evaluations of the project effects on these resources in the basin. In many areas, accurate fish stock assessments, spawning area surveys, and other baseline information are proposed in the EPOA. Many parameters of the without-the-project biological conditions cannot be studied if, as proposed, season extension operations provide for ship passage during the winter pre-project study period. A number of without-the-project studies that we consider important can be properly conducted if the Corps will suspend season extension operations for three consecutive winters and if the Corps is successful in seeking an appropriation from the Congress to adequately fund those studies. This is necessary to determine the environmental feasibility of winter navigation. The plan monitoring studies of the effects of project developments and investigations of the known and presently unknown means and measures necessary to minimize or eliminate the verified adverse effects of the project and to enhance the resource if possible.

At this time, proposed activities are not known to have any effect on endangered fish species or their habitat. These comments were developed without a field survey and do not satisfy the requirements of the formal consultation process referred to in Section 7 of the Endangered Species Act of 1973. The above applies to all subsequent lakes, connecting channels and harbors discussed in this report.

D. Wildlife

1. Without the Project

The diverse terrestrial habitat types of the Great Lakes Basin supports a rich and diverse fauna. There are over 300 species

of birds. Upland game birds include pheasants, ruffed grouse, bobwhite, turkey, mourning dove, woodcock, sharp-tailed grouse, spruce grouse and hungarian partridge. Many waterfowl use the area including whistling swan, Canada goose, snow goose, blue goose, mallard, black duck, blue-winged teal, green-winged teal, wood duck, widgeon, gadwall, redhead, canvasback, lesser scaup, greater scaup, ring-necked duck, ruddy duck, golden eye, bufflehead, mergansers, old squaw, and scoters. There are many more species of songbirds, raptors, shorebirds, wading birds and colonial birds. Big game animals are white-tailed deer, black bear and moose. Small game include snowshoe hare, cottontail, fox squirrel, grey squirrel, raccoon, grey fox and red fox. The furbearers include muskrat, beaver, mink, weasel, otter, skunk, raccoon, red fox, grey fox, coyote, bobcat, lynx, martin and fisher. Other important animals include woodchuck, porcupine, red squirrel, timber wolf, and badger. There are also over 20 species of amphibians and 25 species of reptiles in the basin.

Rare, threatened or endangered animals include the bald eagle, peregrine falcon, Kirtland's warbler, and the timber wolf.

The basin offers over 12 million acres of agricultural and forest habitat for these animals plus the additional millions of acres of lakes and wetlands for the waterbirds.

The shorelands comprise some of the most unique habitats in the basin used by more birds and other animals than most other habitat types. These shorelands range from sand dunes to rock cliffs and have vegetation ranging from the aquatics to the stunted pines and hardwood trees. This habitat amounts to almost a million acres.

The shoreline, islands, wetlands, and shallow waters provide feeding, resting, and nesting habitat for the waterfowl, raptors, marsh birds, shorebirds, wading birds, gulls, terns, cormorants, and songbirds. Millions of these commonly migrate through the basin twice per year. While most migrate and/or breed here, many of these birds are year-round residents in the basin.

The largest problem wildlife faces is the declining amount of habitat. This is the case for uplands, but the rate of loss is accelerating for wetlands and shoreland habitats. Urban and industrial development take most of the habitats. Most of this loss will be in the southern half of the basin where most of the urban and industrial development are located. Much more of the northern half of the basin is in public ownership and in large corporate holdings, not likely to be subject to land use change.

The second most important problem for wildlife and its habitats is the loss and degradation of habitats by pollution. Many areas are being degraded and lost by industrial, agricultural, and urban pollution, particularly shallow water, shoreline, and wetland habitats.

A problem interfering with the use of wildlife resources is the lack of public access. This is especially true in the southern half of the basin where the lands are mostly privately owned.

Since the project is a water development, the effects on wildlife will be felt mostly along the shorelines, islands, wetlands, and the shallow water areas. The terrestrial wildlife will not be greatly affected. Effects would be felt primarily by the waterbirds and aquatic furbearers.

2. With the Project

Various operational measures considered necessary for winter navigation in the Great Lakes could produce changes in the environment which affect wildlife.

The following is a listing of the various proposed developments with the anticipated effects on the wildlife of the Great Lakes.

Icebreaking Requirements

Icebreaking would take place as needed throughout the system. The effects would be most felt where dredged channels are in shallow water areas such as harbors, connecting channels, and bays and basins of the lakes. The powerful icebreaker propeller wash, and to a lesser extent that of commercial vessels, causes high velocity water currents which resuspend sediments, cause turbidity, and scour the bottoms. Benthic communities and aquatic vegetation beds that are used by both fish and wildlife could be displaced or degraded. Icebreaking also creates open water areas which may attract waterbirds including waterfowl. If the birds are in a stressed state, as they are as winter progresses, and if the food supplies at the newly-opened water are limited, high mortality may result when the birds are too weak to move away where food supplies are better. The possibility of spilled contaminants collecting and contaminating waterbirds in these open water areas also exists.

Icebreaker Mooring Improvements

These facilities would be located in designated harbors. They are composed of shoreland storage area, a mooring structure,

and an access channel between the navigation channel and the mooring facility. Detailed discussions and recommendations are not contained in the appropriate harbor portions of this report as details about the facilities are not known.

Ice Control Structures

Ice booms are proposed throughout the basin at harbor entrances and in connecting channels. A more detailed discussion of these structures appears in the appropriate segments of this report. Ice booms themselves should not have significant effects on wildlife resources. At the harbor entrances a small amount of open water may remain behind the booms and this might be attractive to waterfowl as resting areas since most booms will be located over relatively deep water. The anchors will be buried or driven into the bottom and for the most part left in place. This could cause some minor and temporary losses of bottom habitat and benthos. The anchor areas will rehabilitate in a relatively short time if left in place. The booms are attached to the anchors in the fall and removed after spring breakup.

The St. Clair-Detroit Rivers' ice booms will have an effect on the lake levels in St. Clair Lake and Lake Erie. The stabilized ice held back will reduce the flows due to the friction between water and ice. However, this reduction in flow is not as great as the reduction due to existing ice jams that would be eliminated. Therefore, there would be an increase in Lake Erie and Lake St. Clair water levels. The Corps of Engineers is proposing a compensating works which can reduce the flows to the without-the-project condition. The water levels in the lakes should be close to the same as they were naturally. A more complete discussion of these compensating works follows in the connecting channel section.

The ice booms in the St. Lawrence also may retard flows and may adversely affect the head necessary for power generation. However, the original ice booms, put in the river by the power companies, seem to be acceptable. The effects of the proposed additional ice booms are being studied. The results should indicate if there would be a reduction in head.

This proposal would affect the shallow areas and wetlands of the St. Lawrence and the fish and wildlife using them. The extent of these impacts is not known at this time.

Air Bubbler Systems

The air bubblers, if operated as described in the proposed plan, should not have significant effect on the wildlife resources. The bubblers are designed to reduce the thickness of the ice, not to eliminate the ice cover. If operated at low air pressures, the bubblers would not create currents strong enough to resuspend bottom sediments. Neither the operation nor installation of the bubblers would significantly affect wildlife resources unless open water should be created so fish or wildlife could be attracted to the site where spilled oil could collect.

Dredging

Dredging will affect wildlife resources mostly through the disposal of spoil. It is impossible to predict wildlife impacts as most dredging and all disposal areas have not been identified.

Vessel Speed Control and Enforcement

This development, or lack of it, can have a great effect on the fish and wildlife habitat within the areas where pressure waves are generated. The shoreline, wetlands, and shallow water areas are particularly vulnerable to this phenomenon. Vessel speed is one of the factors governing the generation and intensity of these pressure waves. The general areas where this occurs are in shallow areas where dredged navigation channels exist. These include the shallow bays, Lake St. Clair, West Basin of Lake Erie, harbors and their entrances, the connecting channel rivers, and the St. Lawrence River. Excessive ship speed has caused damages in the St. Marys River where wildlife habitat was eliminated. Unless proper vessel speeds are established and enforced, additional wildlife habitat will be destroyed.

Vessel Operating and Design Criteria

As described in the fish section, there are ships presently operating in the Great Lakes which do not have the modifications outlined in the existing operating and design criteria. Wildlife, especially waterfowl and furbearers, are particularly vulnerable and imperiled because these ships are not modified and, therefore, subject to a higher probability of accident. An accident involving unmodified ships could be more severe. The incidence of associated oil or hazardous substance would be higher than an accident involving a modified vessel. The requirement of incorporating these modifications for winter navigation would reduce the probability of accident and resultant spills.

Oil/Hazardous Substance Contingency

We believe that existing spill contingency plans do not adequately protect fish and wildlife resources, particularly fish spawning areas and waterfowl, and especially in flowing water and winter conditions. The elapsed time for a National Strike Team spill recovery contractor and Regional Team to respond to notification of a spill and arrive at a suitable airport nearest the spill is supposed to be a maximum of four hours. Deployment of required equipment will take considerably longer. The spill will thus have opportunity to expand over a large area, especially if carried by currents or driven by wind and waves. Damage to fish and wildlife resources would consist of oiled animals plus habitat damage and destruction. Bald eagles and other fish-eating birds, including their nestlings, could be sickened or killed by eating contaminated fish and birds. Oil on feathers of birds carried to their eggs can kill the embryos. Heavier petroleum products, if spilled, would sink to the bottom covering it and smothering the food, animals, and plants.

If not cleaned up properly, a second contamination could occur if oil is trapped in the ice and released in spring. Vegetation emerging in spring and fish and wildlife would be affected by this second contamination event.

Most spill response equipment such as containment booms and sweeps are ineffective in flowing water and during winter ice conditions. Much better winter spill response equipment and technology than is presently in use is necessary to protect fish and wildlife resources

Until this is done, the fuel from a sunk or damaged vessel or its oil or other hazardous substance cargo could severely damage fish and wildlife resources. All bulk oil and other hazardous substance transport should be suspended until adequate spill response equipment and manpower are available. The Ports and Waterways Safety Act of 1972, 33 U.S.C. Sections 1221-1227 (1975), may provide an existing legal means to achieve this.

Environmental Plan of Action

There is a need for additional information to make detailed evaluations of the project effects on the wildlife resources of the basin. In many areas, baseline data are needed to fully evaluate the impacts associated with extended season navigation. Many parameters of the without-the-project biological conditions cannot be studied if, as proposed, season extension operations provide for ship passage during the winter pre-project study period. A number of without-the-project studies that we consider important can be properly conducted if the Corps will suspend season

extension operations for three consecutive winters and if the Corps is successful in seeking an appropriation from the Congress to adequately fund those studies. These baseline studies are designed to determine the environmental feasibility of the navigation season extension, to identify measures to minimize or eliminate the adverse project effects and to enhance the resource, if possible.

E. Discussion

Impacts of extended navigation in the Great Lakes-St. Lawrence River System have been evaluated in a qualitative manner only. Information is not presently available to make quantitative predictions of the project effects on fish and wildlife resources. Baseline data needs go beyond the collection of existing information since major environmental surveys of fish and wildlife resources, during winter, have not been conducted. In addition, no comprehensive monitoring studies of winter navigation, under ice conditions, are available because the proposed project is the first of its kind in North America.

As a result of identifying the need for extensive data collection, an EPOA has been prepared. This plan would provide, through contracted studies administered by the Fish and Wildlife Service, the information necessary to answer the major questions of fully developed winter navigation. The plan could be implemented concurrently with project planning and thus would include, in addition to needed baseline data and assessment, monitoring studies necessary to evaluate initial operation of the project and ultimately the environmental feasibility of the entire proposal.

There are numerous environmental concerns regarding winter navigation. The most serious question is whether damages to fish and wildlife resources are severe enough to recommend that full winter navigation, either in whole or in part, not be authorized. Some of the winter navigation development proposals seem to produce unavoidable adverse effects. The most significant development proposals and effects on fish and wildlife resources are discussed below.

Vessel movements in shallow or constricted areas will probably increase turbidity above normal winter conditions as a result of prop wash and pressure waves. Winter resuspension and redeposition of sediments near spawning areas could affect vulnerable eggs and early larvae stages of fish. Benthos could be destroyed near vessel tracks. Water quality will be degraded where polluted sediments are resuspended.

Icebreaking activities combined with repeated vessel movements could create additional open water areas which could attract concentrations of waterfowl. Their necessary food supply may be unavailable, either by attraction to less valuable areas, or as a result of winter shipping effects. If this occurs, birds may be weakened, limiting their reproductive success in spring or survivability, if an oil spill occurs. Icebreaking could create underwater ice walls in shallow water which

could affect water circulation and limit fish movement to spawning areas. Icebreaking in nearshore or constructed areas may create unsafe ice conditions for sport and commercial fishermen. Access to traditional fishing sites may be hampered by maintaining vessel tracks throughout winter. Mammal movement might be curtailed in these areas.

Vessel speeds and displacement determine the magnitude of pressure waves. This under-ice phenomena can have serious adverse effects on fish and wildlife and their habitat. Fish could be destroyed in the turbulent currents by being smashed into surrounding ice. The most sensitive habitats which could be affected include shallow water areas, aquatic vegetation beds, benthic communities, wetlands, shorelines, shoals and fish spawning areas. The effects on habitat are most severe because fish and wildlife must rely on these areas year-round during some or all stages of their life histories.

Dredging for new icebreaker mooring facilities and in connecting channels can disrupt fish migration and spawning, destroy benthic communities, fish eggs and larvae. Dredged material can reduce water quality if disposed in open water and destroy aquatic and terrestrial habitat.

The potential for oil, hazardous material and toxic substance spills will increase if winter navigation develops. Some Great Lakes ships do not meet criteria for navigating in ice conditions. The entire contingency plan is untried in winter. While response times of National and Regional Teams are considered optimum, given current constraints, serious effects to fish and wildlife could still result from a major spill. The impact would primarily depend on the volume spilled, substance, timing, weather, location, recovery techniques and currents. Spills are acknowledged to be harmful to fish and wildlife in many ways. Depending on the substance, fish, fish eggs, benthos or aquatic vegetation may be destroyed. Loss of forage fish through a toxic spill could seriously affect the ability of predacious species of fish and wildlife to find enough food for themselves or their young. Ingestion of oil contaminated fish and other biota by predators or scavengers could result in death or sickness. Petroleum products on shore or in the water can get on bird feathers. Birds in the water lose both insulation and buoyancy and almost always die from hypothermia, drowning or poisoning. Only a small percentage are saved through human intervention. Small amounts of oil on surviving birds, which are nesting, can be transferred through eggshells, killing embryos.

Ice booms and ice anchoring islands will be located primarily in connecting rivers and at harbor entrances. Ice boom anchors and islands will displace some benthic habitat. Ice booms in flowing water will restrict flow beneath the stabilized ice cover affecting water levels both upstream and downstream of the structure. Changing water levels would affect lake marshes and other habitats by dewatering or flooding. Compensating works to control ice boom water level effects will displace

fish habitat, could change current patterns and could resuspend polluted sediments. Stable winter water levels would eliminate or minimize losses of fish and wildlife. A rise in water levels in spring and fall would be beneficial.

F. Recommendations

The following recommendations are presented to reduce or eliminate known adverse effects on fish and wildlife and their habitats. The proposed winter navigation project should not be authorized without their implementation.

We recommend a two-phase authorization approach for the Great Lakes Basin portion of the system. This approach entails authorization and funding for detailed studies of fish and wildlife resources and project impacts at project costs, in accordance with Section 2 of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) to be completed prior to authorization for construction.

If, after completion of our recommended studies, it is determined that project-caused adverse impacts to fish and wildlife resources can be avoided, reduced, or compensated for, we recommend that such measures to achieve these ends as may be agreed to by the State natural resource agencies, the Chief of Engineers, other interested natural resource agencies, and the Director of the Fish and Wildlife Service be incorporated into any plan submitted to the Congress to authorize construction and operation or, if after construction, that the project be appropriately modified.

Should we determine that significant adverse impacts to fish and wildlife resources cannot be rectified, we would recommend that specific portions of the project or, if necessary, that the entire project not be authorized for construction or, if after construction, that the specific portions or, if necessary, that the entire project be deauthorized.

Great Lakes Basin Recommendations

1. Conduct surveys and studies necessary for an adequate impact assessment of the planned operational features of the Winter Navigation Program on biological and physical factors affecting the diversity, distribution, recreational use, commercial harvest and long-term stability of fish and wildlife resources. Specific details of the above tasks are presented in the EPOA. Many parameters of the without-the-project biological conditions cannot be studied if, as proposed, season extension operations provide for ship passage during the winter preproject study period. A number of without-the-project studies that we consider important can be properly conducted if the Corps will suspend season extension operations for three consecutive winters and if the Corps is successful in seeking an appropriation from the Congress to adequately fund those studies.

Examples of the studies are:

a. Conduct fall, winter, and spring fish egg and larva sampling and benthic community studies to first identify fish spawning and nursery areas and benthic communities; and secondly, to determine the locations and extent of potential project-related impacts on the above resources.

b. Conduct winter studies to determine where icebreaking and ship passage affect fish and wildlife movement and wintering habitat under ice.

c. Locate wetlands and beds of submerged aquatic vegetation and determine their importance to fish and wildlife resources.

d. Conduct winter studies to determine the amount of ice fishing, location of prime areas, catch-rate, access route to fishing areas and location of alternate areas for fishing.

2. Provide for cooperative monitoring studies of the various proposed developments as they affect fish and wildlife resources and related environmental aspects.

3. Provide a mechanism for implementing monitoring study recommendations to eliminate or reduce fish and wildlife resource and habitat losses that will stem from the project and to enhance these resources where possible.

4. Reduce vessel speed limits in designated areas when fish and wildlife losses occur due to vessel wake, pressure waves and resuspension of polluted sediments. Strictly enforce such limits. These designated areas would be identified by the above recommended studies. If speed reduction cannot be achieved, vessel displacement should be restricted in the system to accomplish the same result.

5. Continue - in coordination with other responsible agencies - to develop a comprehensive list of types and volumes of oil and hazardous materials, substances that are transported in the system or subsystems. The origin/destination of shipments should be identified and used as part of the basis for implementing and drafting agency regulations for the transport of such materials.

6. Improved technology, containment plans, and equipment are needed to provide for better protection of the environment from spills of oil and hazardous materials. An adequate plan should include the strategic storage of effective containment and cleanup equipment, including wildlife cleanup material, and training of responsible (including locally interested) personnel in containment and cleanup operations at all harbors that would be used for the program. During subsequent studies, environmentally sensitive areas may be identified where shipment of hazardous materials and oil should be restricted or limited to ships of certain characteristics. The needed improvements and regulation - up to and including restriction of navigation if necessary - must be developed through interagency efforts.

7. Continue regulatory and enforcement efforts and pursue and develop winter related operation and design criteria (for those vessels operating within the system) into appropriate regulations. Existing laws and regulations should continue to be vigorously enforced to insure safety of navigation and to protect the environment of the Great Lakes. This is particularly relevant in regard to recommendations 5 and 6 above.

8. No dredging to reduce flow velocity in the St. Marys River or in other connecting channels should be done until every alternative has been explored. Dredging should be the absolute last resort. Should no alternative be found, the dredging should be coordinated with the appropriate Federal and State agencies so that fish and wildlife resource losses are minimized.

9. We recommend that the Winter Navigation Season Extension Project for the St. Lawrence River, as currently proposed, not be authorized for construction and operation.

10. If, as a consequence of winter traffic demands, the Corps must pursue Middle Neebish Channel dredging to provide simultaneous two-way traffic, we would like to investigate intensively the feasibility and desirability of restoring the original rapids habitat to the West Neebish Channel. There is opportunity to restore significant rainbow trout, herring, and whitefish spawning habitat here.

11. Ice boom placement should be such that a stable flow and water level is maintained as closely as possible.

12. Where appropriate, conspicuously post warnings of broken ice tracks and clearly mark their location.

13. If project investigations identify endangered species or their habitat in the project area, the formal consultation process referred to in Section 7 of the Endangered Species Act of 1973 should be initiated by writing to the Regional Director, U. S. Fish and Wildlife Service, Federal Building, Fort Snelling, Twin Cities, Minnesota 55111.

The following recommendation supplements those listed for the Lake Superior-Main Lake, Major Bays, Canadian Waters:

1. Conduct a study to determine whether navigation through Whitefish Bay from mid-December into early January is causing or contributing to the problems associated with shifting ice in the Bay during that period. If a cause-and-effect relationship is found to exist, a temporary halt to navigation through the Bay during the early period of ice formation or development of some other solution to allow ice formation could eliminate or mitigate the adverse impacts to the sport and commercial fisheries of Tahquamenon and Pendills Bay.

SILVER BAY, MINNESOTA

The recommendations applicable to Silver Bay are those listed previously for the Great Lakes Basin.

DULUTH, MINNESOTA - SUPERIOR, WISCONSIN

The following recommendations supplement those listed previously for the Great Lakes Basin:

1. The relationship between vessel traffic and spills of hazardous materials in the Duluth-Superior Harbor and dissolved oxygen concentrations should be investigated by persons or agencies expert in water quality problems.

2. If studies show that increased vessel traffic and/or accidental spills significantly lower dissolved oxygen levels in the harbor, a plan should be developed in concert with the Minnesota Pollution Control Agency and Minnesota Department of Natural Resources, Wisconsin Department of Natural Resources, Environmental Protection Agency, and U.S. Fish and Wildlife Service to mitigate and/or compensate that effect.

ASHLAND, WISCONSIN

The following recommendations supplement those listed previously for the Great Lakes Basin:

1. Bubblers should not operate until stable sheet ice has formed. No additional open water should be created.

2. Areas of ice influenced by bubbler operation should be clearly marked to warn winter recreationists of possible unsafe ice.

MARQUETTE, MICHIGAN

The following recommendations supplement those listed previously for the Great Lakes Basin:

1. Conduct a study to determine the magnitude, spatial, and temporal aspects of fish spawning in the area of the proposed bubbler. The results of this investigation should be used to modify the location and perform the work during a specific time period, if necessary.

2. Conduct a study to determine the amount and location of winter bird use in Marquette Harbor.

3. Conduct similar studies in Presque Isle Harbor, if the information is not available, to compare environmental impacts of extended navigation.

4. Evaluate the information in concert with the Michigan Department of Natural Resources, U.S. Environmental Protection Agency, and U.S. Fish and Wildlife Service to determine in which harbor the least, overall adverse environmental impact will result.

5. Recommend either Marquette or Presque Isle Harbor for extended navigation based on the above determination.

ST. MARYS RIVER, MICHIGAN

The following recommendations supplement those listed previously for the Great Lakes Basin:

1. Limit the displacement and speed of vessels during the period of extended navigation through the entire St. Marys River system (Iroquois Point at Lake Superior to Detour, Michigan), to the values required to prevent surge wave damage and other adverse impacts.

2. Channel enlargement dredging should not be pursued in the Middle Neebish Channel. An alternative would be the implementation of a traffic control plan eliminating simultaneous two-way traffic in the existing channel.

3. If, as a consequence of winter traffic demands, the Corps must pursue Middle Neebish Channel dredging to provide simultaneous two-way traffic, we would like to investigate intensively the feasibility and desirability of restoring the original rapids habitat to the West Neebish Channel. There is opportunity to restore significant rainbow trout, herring, and whitefish spawning habitat here.

4. Determine the impact on fish and wildlife habitat of relocating the Soo sewage treatment outfall to Little Rapids Cut and installing riprap on the proposed areas before these subprojects enter the final planning stage.

Lake Michigan - Main Lake, Major Bays, Straits of Mackinac, Michigan

Recommendations applicable to Lake Michigan proper are those listed previously for the Great Lakes Basin.

ESCANABA HARBOR, MICHIGAN

1. Conduct winter and spring fish and larva sampling studies to determine if proposed bubblers and vessel passage could adversely affect lake whitefish spawning and nursery areas.

2. Conduct winter studies to determine the amount of ice fishing, location of prime fishing areas, catch rate, access routes to fishing areas, and alternate areas for smelt and whitefish commercial netting.

3. Confine winter ship traffic to that part of the harbor and Little Bay de Noc where the above studies indicate the least adverse impacts will result.

4. Bubblers not commence operation until stable sheet ice has formed and operation be such that ice thickness is decreased but no additional open water is created.

5. Areas of ice influenced by bubbler operation should be clearly marked to warn winter recreationists of possible unsafe ice.

GREEN BAY, WISCONSIN

The following recommendations supplement those listed previously for the Great Lakes Basin:

1. Develop and conduct a study to reveal the nature, magnitude, spatial, and temporal aspects of avian and aquatic life in and around the harbor and lower Green Bay.

2. Develop a comprehensive spill response plan that includes the training of local personnel, the stockpiling of spill and bird cleanup supplies and wildlife scaring devices; and the identification and securing of suitable space and food sources for cleaning and rehabilitating contaminated birds.

CALUMET HARBOR, ILLINOIS - INDIANA

The following recommendations supplement those listed previously for the Great Lakes Basin:

1. Vessel speeds be restricted as much as possible to minimize resuspension of polluted sediments.

2. Study the effects of resuspended polluted material on water quality and fish and wildlife resources.

MUSKEGON, MICHIGAN

The following recommendations supplement those listed previously for the Great Lakes Basin:

1. Confine winter ship traffic to those parts of the harbor and Muskegon Lake where studies indicate the least adverse impacts will result. This determination should be made in consultation with the Michigan Department of Natural Resources, Environmental Protection Agency, and U.S. Fish and Wildlife Service.

2. Establish and enforce reduced vessel speed limits in Muskegon Lake.

LUDINGTON, MICHIGAN

The following recommendation supplements those listed previously for the Great Lakes Basin:

1. Confine winter ship traffic to those parts of the harbor and Pere Marquette Lake where studies indicate the least adverse impacts will result. This determination should be made in consultation with the Michigan Department of Natural Resources, Environmental Protection Agency and U.S. Fish and Wildlife Service.

STURGEON BAY, WISCONSIN

The following recommendations supplement those listed previously for the Great Lakes Basin:

1. Conduct studies to reveal the nature, magnitude, spatial, and temporal aspects of avian life in and around Sturgeon Bay.

2. Develop an environmental assessment with several alternate sites for mooring facilities, including availability of dredged material disposal facilities.

TRAVERSE CITY, MICHIGAN

The following recommendations supplement those listed previously for the Great Lakes Basin:

1. Locate the mooring facility for a Type C icebreaker at Charlevoix or some other mutually-acceptable site instead of at Traverse City.

2. Develop an environmental assessment with several alternate sites for mooring facilities, including availability of dredged material disposal facilities.

LAKE HURON, MAIN LAKE, MAJOR BAYS

The following recommendation supplements those listed previously for the Great Lakes Basin:

1. Channel enlargement dredging should not be pursued in the Middle Neebish Channel. An alternative would be the development of a traffic control plan eliminating simultaneous two-way traffic in the existing channel. Should the alternative of vessel traffic regulation (discussed earlier in the St. Marys River section) be determined unacceptable, we recommend that the appropriate state and Federal natural resource agencies be consulted to arrive at a methodology for disposal which would minimize adverse impacts to the aquatic ecosystem of Lake Huron.

ST. CLAIR RIVER, MICHIGAN

The following recommendation supplements those listed previously for the Great Lakes Basin:

1. Prepare and implement an environmentally sound plan to simulate the natural biweekly maximum, median, and minimum flows in the St. Clair River and the lake levels in St. Clair Lake and Lake Erie.

LAKE ST. CLAIR, MICHIGAN

The following recommendation supplements those listed previously for the Great Lakes Basin:

1. Develop an environmentally sound plan for the St. Clair River compensating works to duplicate historic (without-the-project) biweekly maximum, median, and minimum levels in St. Clair Lake.

DETROIT RIVER, MICHIGAN

The following recommendations supplement those listed previously for the Great Lakes Basin:

1. Reduce vessel speed or displacement in the Detroit River to the extent that no pressure wave-related adverse effects will occur to benthic communities and to the composition, abundance, and distribution of fishes or their habitat.

2. Prepare and implement an environmentally sound plan to simulate the natural biweekly maximum, median, and minimum flows in the St. Clair River and the lake levels in Lake St. Clair and Lake Erie.

CALCITE HARBOR, MICHIGAN

The following recommendations supplement those listed previously for the Great Lakes Basin:

1. Construct an artificial reef to replace spawning habitat lost as a result of the removal of Calcite Harbor's breakwater.

2. Develop a bubbler operation schedule which would minimize the size and duration of open water areas.

ALPENA (LAKE HURON), MICHIGAN

The following recommendations supplement those listed previously for the Great Lakes Basin:

1. Develop ice stabilization structures to provide winter fishing opportunities.

2. Investigate winter use of Thunder Bay by raptors, including bald eagles.

SAGINAW BAY, MICHIGAN

The following recommendations supplement those listed previously for the Great Lakes Basin:

1. Reef structures should be constructed to concentrate fish away from channel areas.

2. Develop ice stabilization structures to facilitate commercial fishing operations.

3. An impermeable upland site for disposal of any polluted dredged materials should be developed if project-related dredging is necessary.

DRUMMOND ISLAND, MICHIGAN

The recommendations applicable to Drummond Island are those listed for the Great Lakes Basin.

LAKE ERIE

Recommendations applicable to Lake Erie proper are those listed previously for the Great Lakes Basin.

MONROE, MICHIGAN

The following recommendations supplement those listed previously for the Great Lakes Basin.

1. Conduct studies to determine the effects of the proposed bubblers and vessel movement in Monroe Harbor and in the approach to this harbor in Lake Erie. These studies should be coordinated with the appropriate agencies, both state and Federal. Some of the possible effects that should be included are: increased waterfowl overwintering, loss of ice fishing area, increased fish entrainment at the power plant due to ice management, bubblers as attractants to fish and wildlife, increased turbidity, sedimentation and bottom scouring, changes in fish distribution, and wetland degradation or destruction.

2. Commence bubbler operation after stable ice has formed and operate the bubbler so that no open water is created.

3. Areas of ice influenced by bubblers or vessel tracks should be clearly marked to warn winter recreationists of possible unsafe ice.

TOLEDO, OHIO

The following recommendations supplement those listed previously for the Great Lakes Basin:

1. Investigate increased impingement and entrainment of fish and other organisms in the two power plants as a result of vessel passage disturbances.

2. The relationship between vessel traffic and spills of hazardous materials in the Toledo Harbor and dissolved oxygen concentrations should be investigated by persons or agencies expert in water quality problems.

3. If studies show that increased vessel traffic and/or accidental spills significantly lower dissolved oxygen levels in the harbor, a plan should be developed (in concert with the Ohio Department of Natural Resources, Environmental Protection Agency, and U.S. Fish and Wildlife Service to mitigate and/or compensate that effect.

SANDUSKY, OHIO

We recommend that the Winter Navigation Season Extension Project for Sandusky Harbor and Bay, as currently proposed, not be authorized for construction and operation.

HURON, OHIO

The recommendations contained for the Great Lakes Basin should also be applied to Huron Harbor.

LORAIN, OHIO

The recommendations contained for the Great Lakes Basin should also be applied to Lorain Harbor.

CLEVELAND, OHIO

The recommendations contained for the Great Lakes Basin should also be applied to Cleveland Harbor.

ASHTABULA, OHIO

The recommendations contained for the Great Lakes Basin should also be applied to Ashtabula River.

CONNEAUT, OHIO

The recommendations contained for the Great Lakes Basin should also be applied to Conneaut Harbor.

ERIE, PENNSYLVANIA

The following recommendation supplements those listed previously for the Great Lakes Basin:

1. Develop a comprehensive spill response plan that includes the training of local personnel, the stockpiling of spill and clean-up supplies, and wildlife scaring devices; and the identification and securing of suitable space and food sources for cleaning and rehabilitating contaminated birds.

BUFFALO, NEW YORK

The following recommendation supplements those listed previously for the Great Lakes Basin:

1. Develop a comprehensive spill response plan that includes the training of local personnel, the stockpiling of spill and cleanup supplies and wildlife scaring devices; and the identification and securing of suitable space and food sources for cleanup and rehabilitating contaminated birds.

ST. LAWRENCE RIVER, NEW YORK

We recommend that the Winter Navigation Extension Season Project for the St. Lawrence River, as currently proposed, not be authorized for construction and operation.

This document plus the following material comprises the U.S. Fish and Wildlife Service's Coordination Act Report in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.). Accordingly, both documents should accompany your Survey Report to the Congress for authorization.

Sincerely yours,

W. Ellis Klett

W. Ellis Klett
Acting Regional Director

TABLE OF CONTENTS

I. LAKE SUPERIOR - MAIN LAKE, MAJOR BAYS, CANADIAN WATERS

A. Description of Area

Bounded on the north by Minnesota and the Province of Ontario, Canada, and on the south by Michigan and Wisconsin, Lake Superior is the largest of the five Great Lakes. With a 2,800 mile shoreline and a surface area of about 31,700 square miles, it ranks as the largest freshwater lake in the world. It is also the deepest of the Great Lakes, with a maximum recorded depth of 1,333 feet and an average depth of 485 feet. It contains nearly 54 percent of the total volume of water in the entire Great Lakes system. The lake is young geologically, having achieved its present morphometry in the last 3000 - 4000 years with recession of the Carey and Valders Superior Ice Lobes.

The lake drains an area of approximately 80,000 square miles. Over 1000 streams empty into the lake, the largest of which are the the Nipigon, White, Pic, Montreal and Ontonagon Rivers in Ontario and the St. Louis River which empties into the lake at Duluth, Minnesota. The lake's outlet is to Lake Huron via the St. Marys River at Sault Ste. Marie, Michigan. Mean annual discharge at Sault Ste. Marie is 74,000 cubic feet per second. The level of Lake Superior has been regulated artificially by the International Lake Superior Board of Control since 1921 when a 16-gate compensating works was installed at the head of the St. Marys River. The lake level has been maintained since that time at an average of 600 feet above sea level with typical mean annual fluctuations of about 1.1 foot.

It is estimated that over 80 percent of Lake Superior is greater than 100 feet in depth. The major shallow water areas in the lake are found in Whitefish Bay near the lake's southeastern end, the Apostle Island - Chequamegon Bay area of Wisconsin, the Keweenaw Bay area of Michigan, the western lake basin near Duluth-Superior and the Thunder Bay area of Ontario. These areas also contain the more productive fisheries of the lake. The principal islands are Isle Royale, Michipicoten and the Apostle Island group (see Figure 1-A-1).

Lake Superior is unique among the Great Lakes in that it is, in large part, surrounded by high ground with rocky shores. Its watershed is generally defined by a ridge 400 to 800 feet high surrounding the lake, ranging from 10 to 100 miles from its shore. In Minnesota and much of Ontario, the ridge lies even closer to the lake, giving the North Shore a rugged appearance.

Much of the north shore region is composed of exposed ingenous and metamorphic bedrock constituting the southern edge of the Canadian Pre-Cambrian Shield. Soils in the area consist of thin, scattered deposits of glacial drift. Due to the steep relief found near the lake shore, only two or three small wetlands exist along more than 200 miles of Minnesota shoreline.

The southern shore of the lake, with the exception of the Keweenaw Peninsula exhibits considerably less relief with low, flat plains extending inland for several miles along much of its length. Soils along the south shore consist of intermixed gravels, sands, silts and clays laid down as bottom sediments of ancient glacial lakes. Wetlands are more common along the

south shore of the lake and constitute one of the major vegetational features of the area.

The Lake Superior basin is sparsely populated. The only coastal communities in excess of 5,000 population (1970 census) include: Duluth, Minnesota; Superior, Wisconsin (132,815 combined); Ashland, Wisconsin (9,615); Houghton-Hancock, Michigan (10,897 combined); aand Marquette, Michigan (21,967).

Major land-based industries in the basin include iron, copper, and nickel mining; timber harvesting and processing; outdoor recreation and tourism. Industry situated along the coastline includes the processing and shipping of ores, low-sulpher western coal and rain and general cargoes; light manufacturing; commercial development; lake-oriented recreation and commercial fishing.

The rugged, unspoiled and picturesque character of Lake Superior's shoreline, tributary streams, beaches and islands have long attracted visitors from all over the United States. Recognizing the need for reserving representative portions of that landscape for the use, enjoyment and education of present and future generations of Americans, the various states and the Federal Government have established a network of state and national parks, a National Historic Monument, and two National Lakeshores around the periphery of the lake and on its islands.

In 1977, a total of 3,419,880 persons visited or stayed in the 19 State Parks along the Lake Superior shoreline (Michigan - 1,720,341 visitors; Wisconsin -48,547 visitors; Minnesota - 1,651,000 visitors). An additional 91,212 visits were made to the four National Park Service units located on the lake (Isle Royale National Park - 16,676 visits; Pictured Rocks National

Lakeshore -297,189 visits; Apostle Islands National Lakeshore - 91,212 visits; Grand Portage National Monument - 40,055 visits).

Because of its large thermal capacity, water temperatures in the open lake undergo little seasonal change. Surface water temperatures offshore seldom exceed 50 degrees and then only for brief periods. Shallow protected bays may reach 60 degrees or higher at the surface after several days of relative calm. Bottom waters in the lake remain near 40 degrees Fahrenheit (the temperature of maximum water density) throughout the year.

Ice formation on Lake Superior varies in extent from year to year, typically averaging 40 to 50 percent coverage. Though it has never completely frozen over, the lake has approached 90 percent ice coverage on several occasions. Ice formation follows a fairly predictable sequence on the lake: (1) initial ice formation along the shoreline, particularly in harbors and bays (mid-December to mid-January); (2) formation of a zone of ice cover around the lake margin (mid-January to mid-February); (3) ice formation in mid-lake locations resulting in a drifting ice pack (usually mid-March to late April). Depending upon wind directions and velocity and the size of the ice field, ice may pile up to depths of 30 feet or more along shorelines. Areas particularly susceptible to this buildup include the western basin near the Duluth-Superior harbor entrances; Chequamegon Bay near Ashland, Wisconsin; the northwest shore of the Keweenaw Peninsula; and the Whitefish Bay area in the southeastern lake basin.

Lake Superior has essentially maintained its original chemical condition since water quality measurements began in the 1880's. Its waters are known for their high level of purity, low ionic

concentrations and cool temperatures characteristic of northern oligotrophic lakes. Some selected chemical parameters for the open lake are calcium (12.4 ppm), magnesium (2.8 ppm), total nitrogen (0.5 ppm), potassium (0.6 ppm), total alkalinity (46 ppm $Ca\ Co_3$), and total dissolved solids (59 ppm). Because it contains such low levels of plant nutrients and necessary trace elements, Lake Superior is the least productive of the Great Lakes in terms of plant and animal biomass per unit volume.

Lake Superior is a source of water and receiver of effluent from dozens of municipalities and industrial plants situated along its shores. Duluth, Minnesota, has the largest municipal water system, using approximately 18 million gallons per day. The Reserve Mining Company at Silver Bay, Minnesota, is the largest single industrial user of Lake Superior water, accounting for about 90 percent of the estimated 560 million gallons per day withdrawn for industrial purposes.

For the most part, the effects of municipal and industrial effluent discharges have remained highly localized and confined to near-shore waters. A 1976 study by the Minnesota Pollution Control Agency of water quality in the western lake basin did not find detectable levels of hazardous substances such as arsenic, phenols, mercury, PCB's and other chlorinated hydrocarbons. The oxygen levels of Lake Superior waters are at or slightly above saturation at all times of the year and its waters remain among the clearest in the world. Its huge volume in relation to inflow from its watershed is largely responsible for maintenance of its "rainwater-like" chemistry. Of great significance is the fact that should some persistent pollutant ever be allowed to reach dangerous levels in the lake, because of its equally huge volume-to-discharge ratio, nearly 400 years would be required to displace 90 percent of that dissolved substance.

B. Description of Project

The operational measures proposed for implementation for extended season operation on the Lake Superior portion of the system are:

Icebreaking

Icebreaking will be required on the main lake, at harbor entrances, in the harbors, in the tributary lakes and rivers and in the major bays. Ice forms include sheet, drift and pancake ice. Icebreakers will be of two types: deep draft polar (Type B) and shallower draft (Type C). Icebreaking tugs will be used in the harbors. Lake Superior harbors which are expected to receive commercial ship traffic throughout the winter include Taconite Harbor, Silver Bay, Two Harbors and Duluth in Minnesota; Superior and Ashland in Wisconsin; and Marquette-Presque Isle in Michigan.

The Coast Guard has determined that three additional Type C (140 foot) icebreakers will be needed to provide adequate icebreaking and convoy assistance through Lake Superior. One vessel would be berthed in the Duluth-Superior harbor, joining a 180-foot buoy tender presently stationed there. The icebreaker would be responsible for escorting commercial traffic through the western lake basin. A second icebreaker would be stationed at Marquette, Michigan, to provide necessary assistance in the mid-lake region. The third vessel, to be stationed at Sault Ste. Marie, Michigan, would apparently be used primarily in the Whitefish By area.

Icebreaker Mooring Improvements

The additional icebreakers would need mooring facilities and pier space. In some locations additional facilities are not

needed. Specific locations and detailed plans are not available at this time.

Vessel Traffic Control

Vessels in transit will be monitored through a series of preselected check points. Traffic control is designed to prevent collisions and groundings.

Ice/Water Data Collection/Dissemination Systems

An Ice Navigation Center was established for the Demonstration Program. This center receives and disseminates information on ice conditions, weather and related topics.

Aids to Navigation

These developments include the use of Loran C, navigation lights, beacons and radar reflectors. Six permanent navigation lights will be constructed and located in Duluth-Superior Harbor. Two are planned at the head of the St. Marys River. These facilities are rather small and will be located on land or on pile clusters. The effect of these developments on fish and wildlife resources will be insignificant.

Ice Control Structures

These structures are the proposed ice booms. Ice booms are floating logs or metal cylinders chained together and anchored to the bottom. These structures will be placed at several harbors to keep the drift ice from clogging the entrances and making them impassible. The anchors will be left in place year-around, but the floats will be removed in spring and replaced in fall.

Air Bubbler Systems

These developments consist of long perforated pipes, a supply pipe and air compressors. The air pressures used in the system would be between 10 and 15 psi, a relatively low pressure. They are not designed to keep an area ice free, but to reduce the thickness of ice so it can easily be broken. In Lake Superior bubblers are proposed along docks and channels. Bubbler orifices are spaced at approximately 20-foot intervals.

Dredging

Dredging proposed for Lake Superior winter navigation includes that amount needed in harbors to accommodate icebreaker facilities. Spoil disposal plans are not known at this time. Most dredging would occur in harbors where polluted spoil may be present. Plans include dredging deep draft channels from the regular navigation channel to the mooring facility. If the spoil is determined to be polluted, it must be deposited in confined spoil areas. Dredging is also proposed in the St. Marys River to allow two-way traffic.

Compensating Works

There will be no compensating works on Lake Superior. The proposed St. Clair-Detroit River compensating works will have little effect on the water level of Lake Superior.

Shoreline Protection

There presently are no proposed shoreline protection measures for the Lake Superior area. Studies are underway to define areas of shoreline erosion and structure damages.

Island Transportation Assistance

Transportation assistance is proposed in Lake Superior for the Island ferry on the St. Marys River.

Connecting Channel Operational Plans

This monitoring will be done in the connecting channels. There would be no direct effects on fish and wildlife resources.

Water Level Monitoring

This monitoring will be done in the connecting channels. There would be no direct effects on fish and wildlife resources.

Vessel Speed Control and Enforcement

The plan proposes that the U.S. Coast Guard is responsible for the control and enforcement of vessels and their speed. The Coast Guard sees no need to change present speed limits because shoreline damages and erosion are the responsibility of the vessel operator. Cause of damage is determined by the Coast Guard.

Safety/Survival Requirements

These developments will not affect fish and wildlife resources.

Vessel Operating and Design Criteria

These criteria have been developed to promote safe vessel operation in United States waters. For vessels operating in ice,

the criteria are explicit about hull strength, power plant size, strengthened steering mechanisms, special propellers and other special gear. There also are special criteria for oil and hazardous substance transporters. Enforcement of these criteria will reduce the probability of accident and serious spills. Vessels do and will continue to operate that are not in compliance with these criteria. No additional regulations or enforcement are proposed in the plan.

Search and Rescue Requirements

These requirements will not affect fish and wildlife resources.

Oil/Hazardous Substance Contingency Plans

The Coast Guard is the designated responsible agency for these plans on the Great Lakes. These plans include one stockpile of materials used to contain spills. A Regional Response Team also exists and the Service is a member. The National Strike Force, a highly trained Coast Guard unit has a four-hour response time in the Great Lakes area. The actual cleanup of a spill is contracted to private companies. Oil, hazardous material, and toxic substance spills are a potential source of major adverse environmental impacts from this project.

Vessel Waste Discharge (Nonhuman) Requirements

These requirements and standards have been set and enforced by EPA. These requirements include the equivalent of secondary treatment. No wastes are to be discharged into the waters of the lakes. The problem of disposing of these wastes in special harbor facilities is being studies.

Environmental Plan of Action

The U.S. Fish and Wildlife Service and the Corps of Engineers have determined that much information is needed to make a precise evaluation of project effects. The EPOA is an attempt to acquire and evaluate the needed information and predict the effects of the project. The plan also will provide for monitoring project developments to verify predictions, and will culminate in a report recommending ways to eliminate or minimize adverse effects.

C. Fish

1. Without the Project

Of the 173 species of native and introduced fish found in the Great Lakes and their tributaries, sixty-seven are native to Lake Superior. The original fish species composition of Lake Superior is typical of a deep, oligotrophic lake in the northern latitudes. Lake trout and burbot are the major large carnivores. Other species historically abundant in the lake included lake whitefish, lake herring, various deepwater chubs, northern pike, walleyes, perch, sculpins, and various forage minnows.

The cold, open-lake waters have precluded the development of centrarchid and other warmwater fish populations except in the shallow, warmer waters of the major bays and estuaries.

Beginning in 1883 with the introduction of rainbow trout or "steelhead" by the Province of Ontario, Canada, Lake Superior has witnessed a progression of exotic fish introductions. Some species, particularly rainbow trout, brown

trout, chinook salmon, coho salmon and smelt, have made significant contributions to the Lake Superior sport fishery. Certain species introduced in Lake Superior from the lower Great Lakes (i.e., sea lamprey and alewives) have caused severe alterations of the native fish community. Table 1 lists the fishes important from a sport and commercial fishery standpoint.

At one time, virtually all nearshore waters of Lake Superior provided good spawning habitat for lake trout, lake whitefish, lake herring and other species. Severe reductions in the native populations of the above species included the virtual elimination of certain subpopulations which used specific spawning areas. The quality of Lake Superior's shoal areas has not been impaired to any great extent by physical or chemical pollutants that would preclude their future use as spawning sites.

Known major spawning grounds for lake trout, lake herring and lake whitefish in United States waters are as follows and are shown on the map (Figure I-A-1).

	Area	Species
(1)	A large area surrounding the Bayfield Peninsula and Apostle Islands, including the western half of Chequamegon Bay (WI).	Lake trout, whitefish, herring
(2)	Off Little Girl Point in eastern Chequamegon Bay (WI).	Lake trout
(3)	Off Fourteen Mile Point just west of Keweenaw Peninsula (MI).	Lake trout

(4)	Entire zone surrounding the Keweenaw Peninsula (MI).	Lake trout
(5)	Huron Island Area (MI)	Lake trout
(6)	Area from Big Bay Point southeast to Marquette (MI).	Lake trout
(7)	Area encompassing (west-to-east) Shot Point, Shelter Bay, Au Train Bay, Wood Island, Grand Island and Grand Portal Point (MI)	Lake trout, whitefish
(8)	Au Sable Point (MI)	Lake trout
(9)	Crisp Point (MI)	Lake trout
(10)	Tahquamenon Bay and Pendills Bay area of Whitefish Bay (MI)	Whitefish
(11)	Entire Minnesota inshore waters	Lake trout, herring

Most of the tributaries to Lake Superior receive major spring spawning runs of rainbow (steelhead) trout and smelt. In addition, many of the major rivers receive fall runs of coho and chinook salmon, brown trout and brook trout. Available spawning habitat for these species is being increased in Minnesota tributaries through the mechanical removal or modification of natural barriers to upstream movement (falls, etc.) by the Minnesota Department of Natural Resources.

Within the United States waters of Lake Superior, approximately 529,000 angler days of fishing effort are expended

TABLE 1

LAKE SUPERIOR FISHES OF COMMERCIAL OR SPORT FISHERY SIGNIFICANCE

Common Name (Scientific Name)	Commercial	Sport Fishery
Lake trout (Salvelinus namycush)	x	x
Brook trout (Salvelinus fontinalis)		x
Rainbow trout (Salmo gairdneri)		x
Brown trout (Salmo trutta)		x
Atlantic salmon (Salmo salar)		x
Chinook salmon (Oncorhynchus tshawytscha)		x
Coho salmon (Oncorhynchus kisutch)		x
Lake whitefish (Corregonus clupeaformis)	x	
Lake herring (Corregonus artedii)	x	
Lake chub (several species of Corregonus)	x	
Rainbow smelt (Osmerus mordax)	x	x
Northern pike (Esox lucius)		x
Burbot (Lota lota)		x
Walleye (Stizostedion vitreum)	x	
Yellow Perch (Perca flavescens)		x
Longnose sucker (Catostomus catostomus)	x	x
White sucker (Catostomus commersoni)		x
Sea lamprey (Petromyzon marinus)	Species has had great impact on the sport and commercial fishery of Lake Superior.	

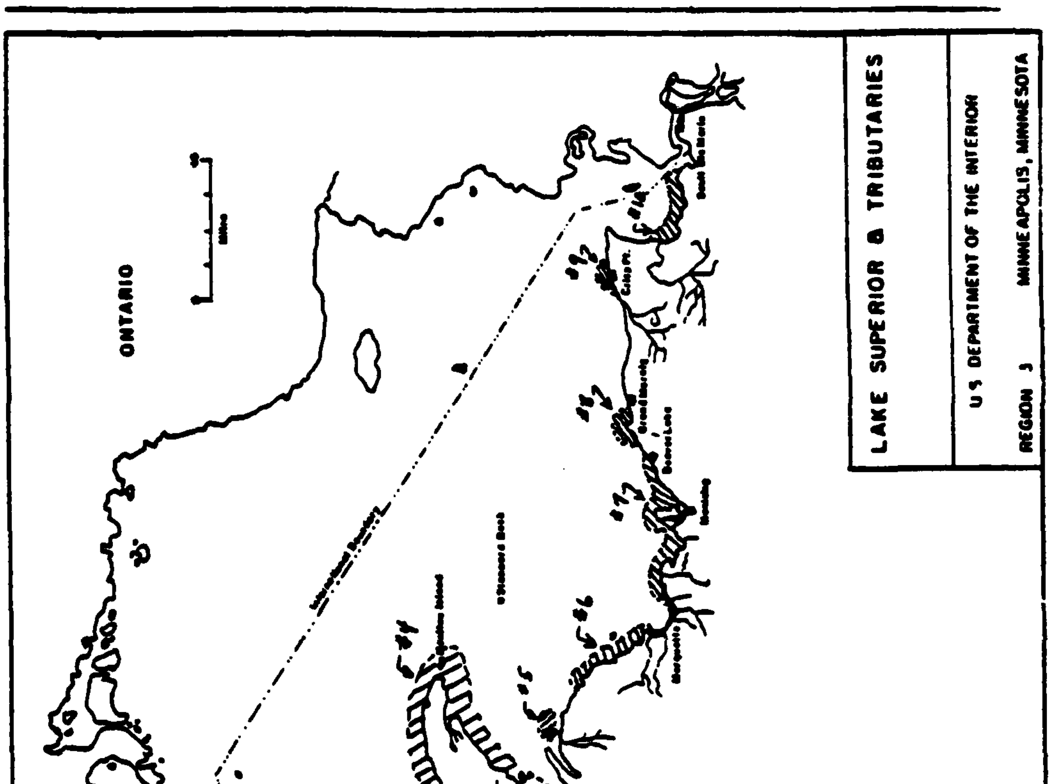
LAKE SUPERIOR & TRIBUTARIES
U.S. DEPARTMENT OF THE INTERIOR
REGION 3 MINNEAPOLIS, MINNESOTA
ONTARIO
ONTARIO
MINNESOTA
WISCONSIN
MICHIGAN
ISLE ROYALE
Silver Bay
Taconite Harbor
Spawning Areas

FIGURE I-A-1

annually, of which 41,500 are estimated to occur during the winter months. The most popular open lake game fish is the lake trout. Other species important to the sport fishery include rainbow trout, coho and chinook salmon, walleyes, yellow perch and brown trout.

Recreational fishing for lake trout became popular in the late 1800's when the fish was abundant. Fishing success for trout remained good through the early 1950's and then dropped off sharply as the impacts of sea lamprey predation and commercial fishing took their toll. The rainbrow trout, along with the more recently introduced coho salmon, chinook salmon and brown trout have helped fill the sport fishing void created by the decimation of the lake trout fishery. The increase in lake trout abundance witnessed over the past ten years has caused a parallel increase in sport fishing activity along the Lake Superior shoreline and around its islands. The migratory spawning runs of rainbow and brown trout and coho and chinook salmon attract thousands of fishermen to Lake Superior's tributary streams each spring and fall. Approximately 60,000 angler days of fishing effort were expended on Minnesota tributaries in 1977 in pursuit of rainbow trout alone.

Fishing for walleyes and perch takes place mainly in the warmer waters of harbors, shallow bays, channels and estuaries. The smelt, an invader of Lake Superior waters in the 1930's resulting from experimental plantings in lower Great Lakes tributaries, attracts a large number of dipnet fishermen to the lake's tributary streams in early April through early May when it makes its short but spectacular spawning run. The size of the sport harvest probably outranks all other fish species.

While fishing effort during the summer months tends to be fairly well dispersed along the entire coastline, winter fishing tends to take place in a few popular areas in Michigan and Wisconsin waters. Principal ice fishing grounds include the Apostle Island - Chequamegon Bay area in Wisconsin and Keweenaw Bay, Huron Bay, the Portage Canal on the Keweenaw Peninsula, upper Marquette Harbor, the south half of Whitefish Bay, and offshore from Munising in Michigan. A number of the more productive ice fishing areas are located several miles offshore. Travel to these areas by snowmobile is common.

The lake trout, along with lake whitefish, formed the backbone of the early Lake Superior commercial fishery. The lake trout of Lake Superior consists of two distinct subspecies - the "lean" lake trout and the "fat" lake trout or "siscowet." The lean lake trout are found in inshore waters and on the banks of most offshore islands, generally at depths greater than 300 feet. The siscowet is generally found at depths greater than 300 feet and is morphologically distinquishable from the lean trout by a number of characteristics (fat content, body depth, growth rate, etc.). The lean trout has historically been far more significant to the Lake Superior sport and commercial fishery and the following discussion pertains largely to that subspecies.

Lake trout and lake whitefish were virtually the sole components of the Lake Superior commercial fishery dating back to the 1830's. The lake whitefish was the preferred species and provided more to the commercial harvest during the early years. After providing a peak United States harvest of 4.5 million pounds in 1885, whitefish populations declined

significantly over the next 60 years. The lake trout harvest surpassed that of the whitefish by 1890 and in 1903 a record of 5.6 million pounds of lake trout were taken from United States waters. Also a victim of overharvesting, the lake trout declined somewhat in abundance in the early 1900's but continued to provide between two and three million pounds to the commercial harvest annually through the early 1940's. Weakened by many years of overharvesting remaining lake trout and lake whitefish populations were extremely vulnerable to attack by the parastic sea lamprey when the latter invaded Lake Superior from the lower lakes in about 1942. The 1950 saw the beginning of near decimation of the lean lake trout population and further reductions in the whitefish population. The combined effect severely damaged the Lake Superior commercial fishery and drove many fishermen out of business.

The lake herring was of only local importance as a commercial species during the early and mid-1800's. Being smaller and less marketable than either the trout or whitefish, it and less marketable than either the trout or whitefish, it was not seriously sought until the 1890's when whitefish stocks declined. The harvest of lake herring reached 6 million pounds by 1903 and continued to provide a larger portion of the total lake harvest over the next 50 years. Subjected to intense fishing pressure on its spawning grounds herring stocks were severely depleted or, in some cases, virtually eliminated in certain parts of the lake by the mid-1960's.

With the severe reductions in the lake trout, lake herring and lake whitefish populations, commercial fishermen have either left the industry or turned to less valuable fishes

such as deepwater chubs, smelt or suckers. About 210 fishermen continue to commercially fish the United States waters of Lake Superior. The amount and value of their catch, by species, is shown in Table 2.

On an optimistic note, the development of a selective larvicide for sea lamprey has made possible a reduction in the population of the parasitic fish to about 10 to 15 percent of its abundance in the late 1950's. Due largely to sustained large-scale lake trout stocking programs by all three bordering states, there has been a strong resurgence in lake trout abundance. Lake-spawned fish are becoming more prominent in assessment samples each year indicating that many of the stocked trout are beginning to reproduce successfully.

Aside from commercial fishing by members of the Bay Mills Indian Reservation in the Whitefish Bay Area and the Red Cliff Reservation around the Apostle Islands in Wisconsin, the commercial catch of lake trout from Lake Superior has been limited since 1962 to those taken for population assessment purposes. The total incidental and assessment catch for all United States waters in recent years has been between 200,000 and 300,000 pounds annually.

The outlook is good for continued recovery of the lake trout in Lake Superior. There is little likelihood that it will be subjected to commercial fishing in the near future. The lake whitefish appears capable of sustaining its 1976 harvest rate over the long term. The ability of the lake herring to maintain its present harvest is questionable. Over the past three years, the State of Minnesota has stocked 40 million herring fry annually in an attempt to revive

TABLE 2

WEIGHT AND VALUE OF THE 1976 LAKE SUPERIOR COMMERCIAL FISHERY HARVEST

Species	Weight of Catch (lbs.)	Dollar Value
Lake trout	315,673	$ 203,030.00
Lake Whitefish	741,069	$ 599,898.00
Lake herring	446,942	$ 117,416.00
Chubs (several species)	1,235,628	$ 752,874.00
Smelt	3,092,410	$ 91,444.00
Suckers	31,301	$ 2,091.00
Other Species	88,777	$ 4,277.00
Total	5,951,800	$1,771,030.00

that once important fishery. Any increase in the commercial fish harvest on Lake Superior will apparently have to come through heavier fishing pressure on species of lesser commercial value, such as rainbow smelt, chubs and suckers.

There are no Federally endangered fish species known to exist in Lake Superior or its watershed.

2. With the Project

The effects of vessel movement on fish in deep water during winter are not known.

The following is a list of various project segments with anticipated effects on the fishes of Lake Superior.

Icebreaking

Icebreaking will take place on the open lake, in harbors, connecting channels and bays. Effects are thought to be concentrated in shore areas, shallow bays and harbors. Propeller wash could cause sediments to become resuspended, displacing benthic organisms. Fish would be exposed to turbulent currents causing additional stress. Loss of fishery resources could result from both effects.

In Whitefish Bay early icebreaking activities (December 15 to January 1) are thought responsible for a delay of up to two weeks in the establishment of a dependable, nonshifting ice cover. The problem occurs when shifting winds cause the ice sheet in the southern half of Whitefish Bay

to break free from shore and drift toward the center of the bay piling ice both along shore and adjacent to the navigation channel. While the cause-and-effect relationship has not been identified, navigation through Whitefish Bay during initial bay ice formation may be partially responsible for the delay experienced by sport and commercial fishermen getting to their fishing grounds. Approximately twenty of the commercial fishermen in Pendills Bay are Indians whose rights to fish the area are granted by treaty.

Icebreaker Mooring Facilities

Additional icebreakers would need mooring facilities and pier space. An access channel may be needed between the navigation channel and the proposed pier. The project plan does not provide enough detail to determine what resources may be affected. We assume that these mooring facilities will be located at or near existing Coast Guard facilities.

Air Bubbler Systems

The air bubblers, if operated as proposed, should not produce significant effects on the fishes of Lake Superior. Air pressures would not produce an air curtain effect because the jets are spaced approximately 20 feet apart and the bubbles would not spread far enough to meet. Currents generated would probably not be strong enough to resuspend bottom sediments. The operating plan does not state whether the bubblers would be operated continuously or intermittently. Neither operation would significantly affect the fishery. There might be a local increase in dissolved oxygen levels. Other effects will be discussed in the appropriate discussion sections.

Dredging

Fishery resources of Lake Superior would be adversely affected by dredging of access channels for icebreaker mooring facilities. Placement of spoil could also cause adverse effects. A more detailed discussion of this development will appear in the appropriate harbor sections of this report.

Vessel Speed Control and Enforcement

This part of the plan could have a profound effect on fishery resources of the basin. Vessel speed is one factor contributing to the pressure waves that can occur in confined channels. Two of these areas in Lake Superior are Mosquito Bay and the lower portion of Whitefish Bay. Excessive vessel speed (even if within the legal limit) has caused severe environmental damages in other parts of the system. Fishery resources have been eliminated directly and their habitat and food supply reduced. Without adequate vessel speed limits and enforcement at the above-mentioned critical areas, fishery resources could be severely affected.

Vessel Operating and Design Criteria

Presently there are ships operating in the Great Lakes which do not have the modifications outlined in the coast Guard's operating and design criteria. Fishery resources and human lives are imperiled because ships are not modified to include the needed safety features. Strict requirements, incorporating these modifications for winter navigation, would reduce the chance of a major disaster.

Oil/Hazardous Substance Contingency Plans

The lack of compliance with the operating and design criteria causes the probability for a spill and probable severity of a spill to increase. Existing contingency plans are untried in winter. Several of the described contingency plan segments do not adequately protect fishery resources. The National Strike Team response time of four hours is inadequate for a spill in the flowing waters of the connecting channels or during a period of high winds. A spill could travel a long distance downstream or downwind in that time. The containment booms have not performed satisfactorily even under more ideal conditions than found in winter. Response time for the regional teams also is too long to assure the prevention of damage to fish and wildlife. By the time cleanup equipment is on the site, the spill can extend downstream or downwind a considerable distance. Fish habitat could be damaged. Fish eggs could be destroyed and spawning habitat could be made unusable even if fish eggs are not present. A spill also could destroy the benthic community since heavier petroleum products will sink to the bottom. Existing cleanup capabilities do not appear adequate to prevent serious environmental damages.

Environmental Plan of Action

Much information concerning the fishery resource of Lake Superior is needed to make a more detailed and accurate evaluation of project impacts. Accurate fish stock assessments, spawning area surveys and other baseline studies are proposed in the EPOA. The EPOA will also provide for monitoring studies and will result in recommendations to eliminate or minimize adverse environmental impacts.

D. Wildlife

1. Without the Project

Wildlife resources of the Lake Superior basin provide many hunters, photographers and wildlife observers with high quality recreation. The basin's virgin stands of red, white and jack pine forests of pre-settlement time offered little in the way of habitat diversity for wildlife. Species diversity and abundance were relatively low. Settlement and logging of the area during the early 1800's in Michigan and Wisconsin and the early 1900's in Minnesota brought about drastic changes in the vegetative characteristics of the basin. The creation of forest openings and the increase in vegetative diversity brought a parallel increase in the abundance and diversity of birds and animals.

One of the animals to benefit most from logging and settlement was the whitetail deer. The whitetail is the most important big game animal in the Lake Superior Basin. It is abundant in the Michigan and Wisconsin portions of the basin and is common in the Minnesota portion. Another big game animal in the basin is the moose. The moose is abundant in northern Minnesota and has been hunted on a restricted permit basis for several years. Moose are present but not common in Michigan and Wisconsin and are totally protected by both states. The black bear is common throughout the basin and is considered a big game animal by all three states.

Resident small game mammals include the snowshoe hare, eastern cottontail and red and gray squirrels. Beaver, muskrat, mink, red fox, and coyote are commercially important furbearers. The trapping of bobcat, lynx, otter and fisher

is either prohibited or closely regulated by the states. The taking of pine martin and timber wolves is uniformly prohibited by all three.

Resident game birds in the basin include ruffed grouse and spruce grouse. The ruffed grouse is an extremely popular game bird in all three states as is the woodcock, a migratory shorebird that is adapted to a forested habitat.

A variety of migratory waterfowl, wading birds and shore-birds nest in the basin while others use the area primarily for resting and feeding during their spring and fall migrations. Ducks include mallards, black ducks, wood ducks, lesser scaup, blue-winged teal, mergansers, ring-necked ducks and common goldeneyes. The more commonly occurring wading birds include the great blue heron, American bittern and, to a lesser extent, the green heron and great and cattle egrets. The Canada goose is the only goose to nest in the basin. In addition to the above, a variety of shorebirds (plovers, sandpipers, killdeer), terns and gulls nest along the Lake Superior coastline and harbors. Waterfowl observed in the basin, primarily during spring and fall migrations, include snow geese, coots, buffleheads, green-winged teal, pintails, and American widgeon.

A variety of raptors nest in the basin, and several spend winter along the Lake Superior coastline. This group includes marsh hawks, red-tailed hawks, ospreys, the bald eagle, great horned owl and long-eared owl. The snowy owl, great horned owl and bald eagle are known to winter in a number of communities on or near the shore.

Of the nearly 200 species of songbirds nesting or migrating through the basin, none is Federally listed as endangered. While nearly all species of resident and migratory birds and mammals make use of Lake Superior's inshore waters, shoreline, and adjacent wetlands during spring through fall, relatively few of them maintain that association through the winter months. With the departure of the herring gulls in December, the use of the open lake by migratory birds virtually ceases except for old squaw and scoters until the following spring. Some gulls and diving ducks may overwinter in water areas kept open by heated power plant discharges, but their numbers are small. Great horned and snowy owls winter near grain elevators or landfills feeding on pigeons, rats or waterfowl mortalities.

In the wetlands and tributary streams, mink and otter remain active throughout the winter while beaver and muskrats remain in their lodges until the following spring. Along more northerly parts of the Minnesota shoreline, timber wolves commonly travel the ice margin that builds up in February or March and may be observed up to a mile from the mainland in early morning. Deer seldom venture onto the ice, but may do so if pursued by wolves or dogs.

Minnesota, Wisconsin and Michigan have management authority over all wildlife within their respective borders. The states have generally similar management programs for classes of wildlife (i.e., big game, small game, migratory waterfowl, furbearers, predators, etc.) but differ somewhat in their management objectives and means of attaining those objectives (i.e., season dates and lengths, bag limits, permit quotas, etc.).

The only threatened or endangered mammal in the Lake Superior Basin is the Eastern timber wolf which is classified as threatened in Minneosta and endangered in Wisconsin and Michigan. Endangered bird species found within the Lake Superior Basin include bald eagle, which nests in all three states, and the peregrine falcon, which passes through the area on its spring and fall migrations. Efforts to introduce the peregrine falcon to Lake Superior's North Shore area will soon be underway. The bird has been absent from the eastern United States for many years.

2. With the Project

Operational measures considered necessary for extended season operation on Lake Superior could produce changes in the environment which would affect wildlife resources.

The following is a listing of the various segments of the project with anticipated effects on the wildlife of Lake Superior.

Icebreaking

Icebreaking will take place throughout the system. The effects are concentrated in near-shore waters, shallow bays and harbors. Propeller wash could cause current which re-suspend sediments and cause bottom scour displacing benthic communities used as food by wintering waterfowl and shore-birds. Icebreaking may also create open water areas which would attract wintering birds.

Icebreaker Mooring Improvements

Additional icebreakers would need mooring facilities and pier space. An access channel may be needed between the pier and the navigation channel. The project plan does not give enough detail to determine what resources may be affected. We assume that these facilities will be located at or near existing Coast Guard facilities.

Air Bubbler Systems

The air bubblers, if operated as described in the proposed plan, should not have significant effect on wildlife resources. This would be true if bubblers do not create areas of open water. Bubblers, operated at low air pressures, would probably not resuspend bottom sediments. The operating plan does not state whether the bubblers would operate continually or intermittently. A more detailed discussion of the effects of this development will be presented in the appropriate harbor sections.

Dredging

Dredging may be necessary for the proposed icebreaker mooring facilities. Both dredging of channels and associated spoil placement would affect wildlife resources.

Vessel Speed Control and Enforcement

This development can have a profound effect on the wildlife habitat within area of pressure wave generation. The shoreline, wetlands and shallow water areas are to be particulary vulnerable to this phenomenon. Vessel speed is one of the

factors governing the generation of these pressure waves. The areas where these waves can be generated include the lower portion of Whitefish Bay and Mosquito Bay. Excessive vessel speed has caused severe damages in other parts of the system. Wildlife habitat has been eliminated. Without adequate vessel speed limits and enforcement at the above-mentioned critical areas, wildlife habitat could be severely affected.

Vessel Operating and Design Criteria

As described in the fish section, there are ships presently operating in the Great Lakes which do not have the modifications outlined in the Coast Guard's existing operating and design criteria. Wildlife resources, especially waterfowl, are particularly vulnerable and imperiled because these ships are not modified. Strict requirements incorporating these modifications for winter navigation would reduce the chance of a major disaster.

Oil/Hazardous Substance Contingency Plans

Existing contingency plans are untried in winter. Several of the described plan segments do not adequately protect wildlife resources, particularly waterfowl. The response times for the National Strike Team and the regional teams are too long. By the time the equipment is on site, the spill could extend a long distance, especially when carried by strong currents or driven by winds. Heavier petroleum products will sink to the bottom smothering benthic food organisms. Vegetation emerging out in spring also could

be affected by a winter spill. In addition to the long response times, some containment and clean up equipment is not completely efficient. More effective equipment should be obtained and conveniently stockpiled throughout the basin.

Environmental Plan of Action

As was described in the fish section, this plan is designed to acquire information that will allow a detailed and accurate evaluation of project impacts.

E. Discussion

Possible impacts of extending the navigation season have been mentioned in a qualitative manner in previous sections. Much information is not presently available to make quantitative predictions about the project effects on fish and wildlife populations and habitats.

Vessel passage through constricted areas of eastern Lake Superior could cause movement of bottom materials where depths are less than 40 feet. Since both the lake trout and lake whitefish are fall spawners, winter disturbance of sediments near spawning areas could affect vulnerable egg and early larvae stages. Whitefish spawn in Whitefish Bay and Mosquito Bay. Ship traffic could also affect ice fishing which occurs in the bays, near some of the islands and off some areas of the mainland. Spills or discharges of oil, hazardous materials and toxic substances would adversely impact the eggs or larvae of lake whitefish and lake trout. Production of benthic organisms could also be reduced.

Effects of dredging for new icebreaker mooring facilities may include disruption of fish migration and spawning, reduction

in production of benthic organisms, mortality to fish eggs and larvae and destruction of aquatic and terrestrial habitat. Sediments in several Lake Superior Harbors are polluted and can only be disposed of in impermeable containment facilities.

Icebreaking in nearshore areas has the same effects as previously described for vessel passage with the addition of creating unsafe ice conditions for sport and commercial ice fishing. Access to traditional fishing sites might be hampered by maintaining vessel tracks throughout the winter.

There is an apparent impact to Whitefish Bay sport and commercial fisheries caused by the delay in the establishment of a sound ice cover. This situation should be studied.

The Great Lakes' few sheltered open water areas with an adequate food supply are important to wintering waterfowl. Waterfowl from a widespread breeding area are concentrated in these areas and feed on small fish and benthos. If this food supply is depleted, they may be unable to find another protected area with adequate food. The nutritional state of migrating waterfowl in fall and early winter is very important. Reproductive success depends on adequate nutrition in the pre-reproductive period of spring migration. If fish and benthos are reduced by winter shipping, waterfowl reproductive success might be affected. The impact of reduced benthos and fish life is not limited to waterfowl. Gulls, terns, herons, grebes, ravens, cormorants, crows and terrestrial carnivores scavenge dead fish and actively pursue live ones. Gulls, terns, mergansers, grebes and cormorants absolutely require fish.

The probability for elimination of benthos and fish from large parts of the harbors and well beyond may be greater from discharges and spills than from the mechanical impact of ship passage. The impact would depend on the timing, substance, weather, clean-up effectiveness and other factors. The loss of a year-class of small fish would seriously affect the ability of other fish as well as gulls, terns, cormorants and herons, to survive. Spills and discharges are known to be harmful to fish and wildlife. Both internal (ingestion of contaminated food) and external factors result in mortality. For example, birds in the water at the site of petroleum spills lose both insulation and buoyancy and, unless only very lightly oiled, almost always die from hypothermia, drowning, or poisoning. Even with the best available human intervention, a very low percentage of oiled birds survive. Recent research indicates that even small amounts of oil from a nesting bird's plumage can kill the embryos in eggs. Thus, even if the oil is not fatal to a bird that encounters it, it could reduce that bird's reproductive success.

During winter, fish and waterfowl congregate in winter harbors that have both open water and protection. This is a period of great stress due to scarce food supplies and increased energy requirements for body maintenance. Further stresses may result from the crowding and the unavailability of desirable habitat. Expenditures of energy that have no return value will be required if birds flee oncoming ships. Whether this will be directly or indirectly harmful is know known. It is certain, however, that additional stress will have an adverse impact.

F. Recommendations

The following recommendation supplements those listed previously for the Great Lakes Basin, part F:

AD-A084 207   CORPS OF ENGINEERS DETROIT MI DETROIT DISTRICT   F/G 13/10
GREAT LAKES AND ST. LAWRENCE SEAWAY NAVIGATION SEASON EXTENSION--ETC(U)
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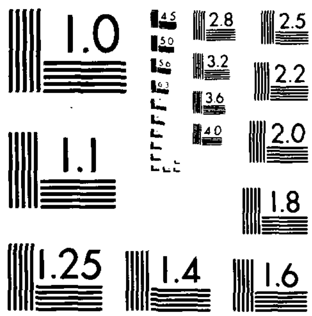
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(1) Conduct a study to determine whether navigation through Whitefish Bay from mid-December into early January is causing or contributing to the problems associated with shifting ice in the Bay during that period. If a cause-and-effect relationship is found to exist, a temporary halt to navigation through the bay during the early period of ice formation or development of some other solution to allow ice formation could eliminate or mitigate the adverse impacts to the sport and commercial fisheries of Tahquamenon and Pendills Bay.

II. LAKE SUPERIOR HARBORS

A. Silver Bay, MN

1. Description of Area

Silver Bay, Lake County, Minnesota, lies approximately 55 miles northeast of Duluth, Minnesota, on the north shore of Lake Superior. The topography is typified by steep, rocky bluffs of variable height which parallel the shoreline. In some places, near vertical bluffs up to several hundred feet in height occur. Short, narrow gravel beaches may fill the void between rocky outcroppings. Soils in the area are relatively infertile. Natural harbors and wetlands are uncommon and none occur within the project area. Silver Bay Harbor was constructed by Reserve Mining Company to accommodate one large lake vessel at a time. It consists of a relatively straight stretch of shoreline protected on either end by the construction of two rock rubble breakwaters. Both breakwaters are at approximately right angles to the shoreline and tie into small islands at their outer ends. Depths in the harbor range from approximately 100 feet at the outer end to 30 feet dockside.

The only cargoes handled at the dock are coal and taconite pellets. Coal is brought into the harbor, loaded on railroad cars, and hauled 40 miles inland to Reserve Mining's mine area near Babbit, Minnesota, where it is used to generate power for mining and taconite processing operations. Processed taconite is loaded on ships bound for steel mills on Lake Erie.

Attesting to the beauty of the north shore region of Lake Superior, four State parks within a 20-mile radius of Silver Bay received 426,355 visitors in 1977.

The industrial discharge from Reserve Mining's taconite processing plant in Silver Bay flows directly into Lake Superior. Components of that 67,000-ton daily discharge include rock fragments, asbestiform fibers, and 629,000 pounds of manganese. The asbestiform fibers are suspected of being carcinogenic to humans and have been found in municipal water supplies as far away as Duluth (55 miles). Normal shore currents carry taconite processing by-products into the harbor area. Reserve Mining Company has been ordered by a Federal Court to cease dumping into Lake Superior by mid-1980, and an inland tailings disposal site has been agreed upon by the Company and the State of Minnesota.

2. Description of Project

The plan of development for winter navigation in the Silver Bay Harbor consists of placement of one 2,000-foot bubbler alongside the loading dock and dock approach. (Figure II-A-2-1). The bubbler system would be suspended by wire or cable approximately four feet above the lake bottom. Water depths in the vicinity of the bubbler ranges from about 60 feet at its outer end to about 30 feet at its inner end. Air emitted from the bubbler pipe will cause a gentle bubbling action.

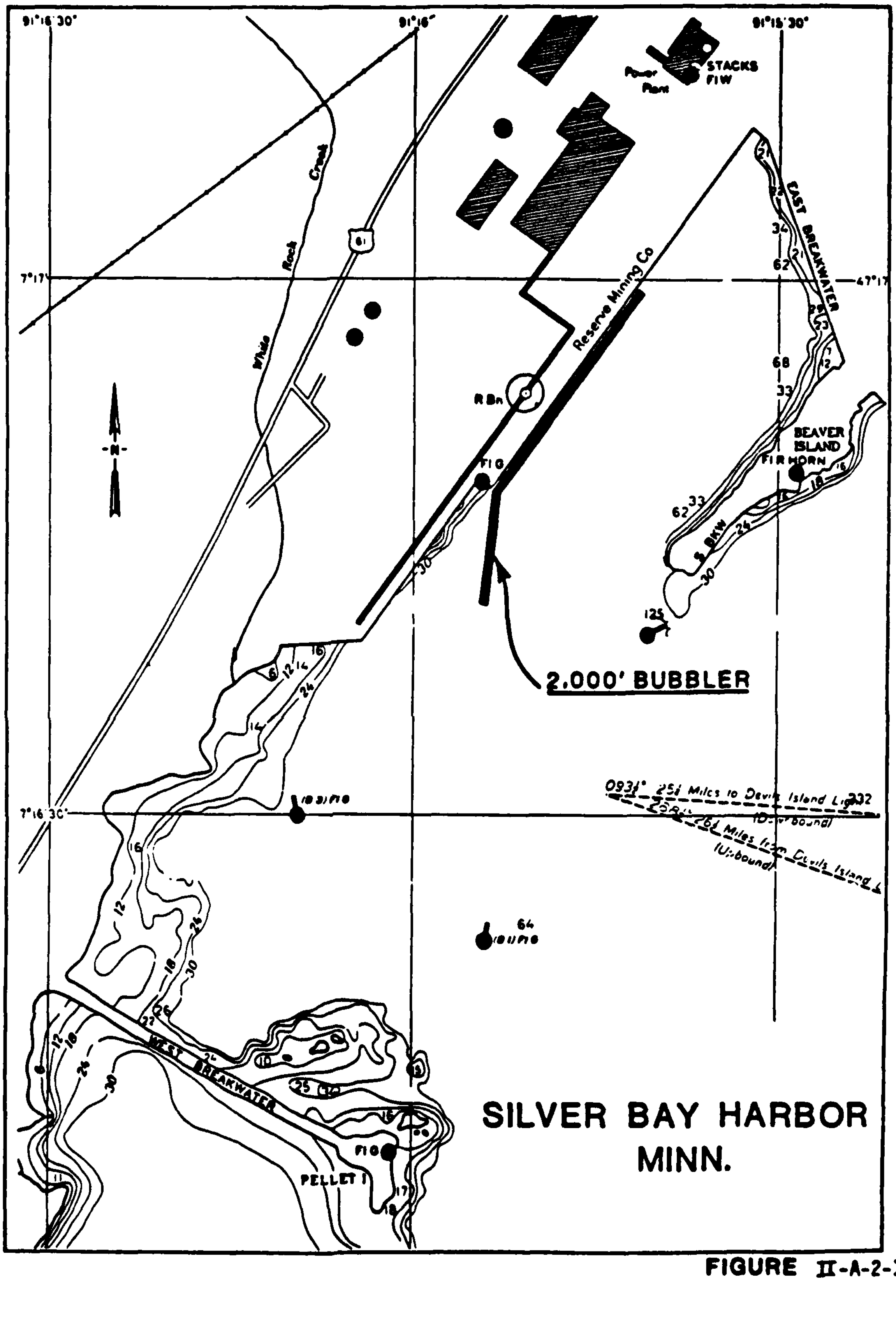


FIGURE II-A-2-1

3. Fish

a. Without the Project

It is unlikely that Silver Bay Harbor holds a significant resident fishery population. The shallow areas are possibly inhabited by white and longnose suckers and minnows. During the summer months, most of the Lake Superior salmonid species probably pass through the harbor area. Aside from the shoal area around Pellet Island and the west breakwater, little shallow water fishery habitat exists in the harbor.

There is no fishery management effort developed specifically for Silver Bay Harbor.

There is little if any sport fishing and no commercial fishing in or adjacent to the Silver Bay Harbor. There are not believed to be any endangered fish species in or near the Harbor.

b. With the Project

No change is anticipated in fish species composition, habitat use, management, or harvest as a result of the plan of development for the navigation season extension program in Silver Bay.

4. Wildlife

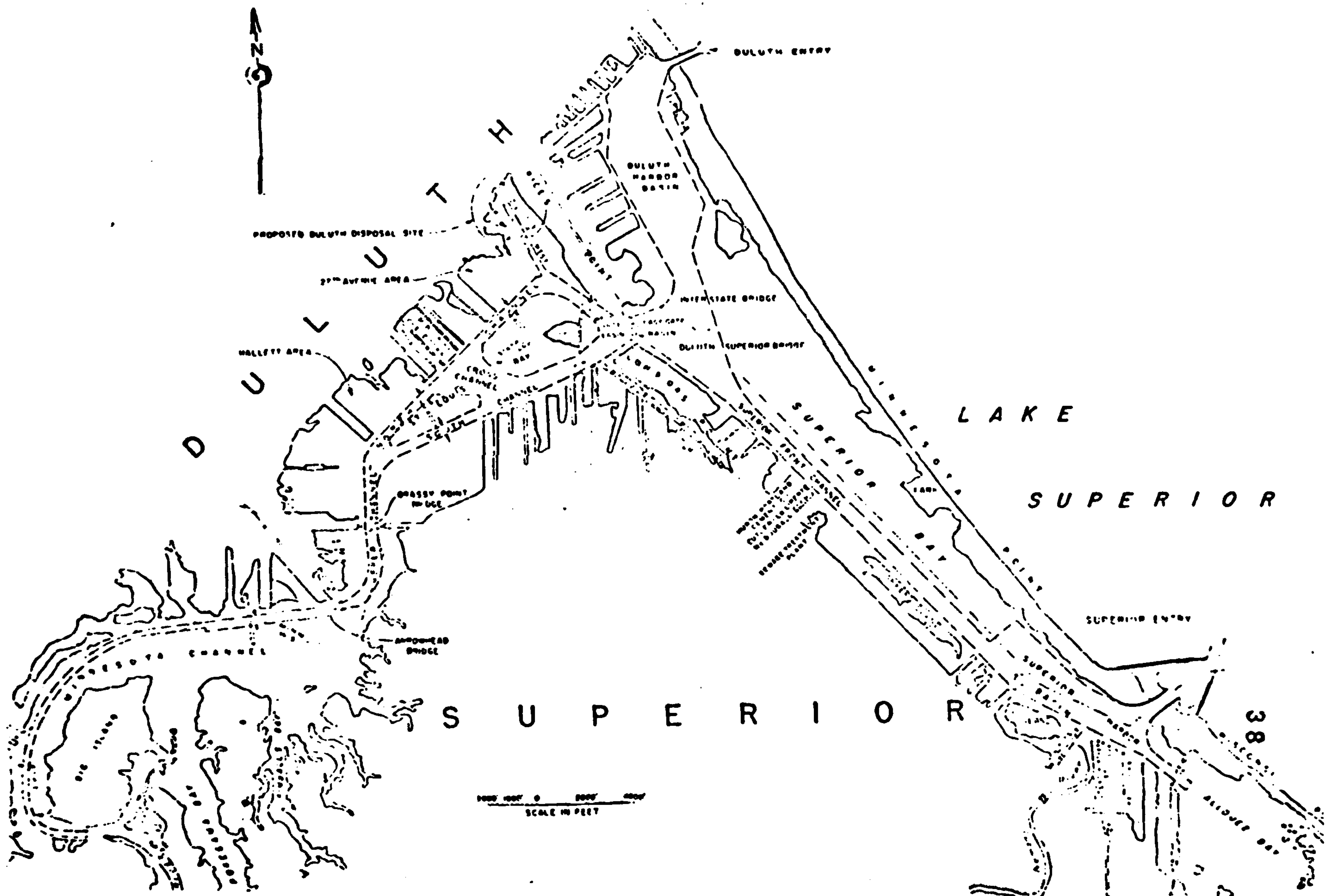
a. Without the Project

Wildlife species of the Silver Bay area are similar to those described for the north shore sub-basin in the Lake Superior basin. The area adjacent to Lake Superior in the vicinity of Silver Bay is a State game refuge. Consequently, hunting for resident and migratory game is prohibited at all times.

The area surrounding Silver Bay has been designated as critical habitat for the threatened eastern timber wolf. Efforts to introduce the Federally-endangered American peregrine falcon to the North Shore may take place in the vicinity of the Silver Bay Harbor. The endangered Arctic peregrine falcon may pass through the Silver Bay area on its spring and fall migrations.

b. With the Project

We anticipate no change in wildlife species composition, habitat use, management, or harvest as a result of the plan of development for the navigation season extension program in Silver Bay. We anticipate no impact on endangered wildlife species as a result of the improvements planned for Silver Bay.


N
DULUTH
DULUTH ENTRY
DULUTH HARBOR BASIN
PROPOSED DULUTH DISPOSAL SITE
27TH AVENUE AREA
INTERSTATE BRIDGE
DULUTH SUPERIOR BRIDGE
HALLETT AREA
GRASSY POINT BRIDGE
ARROWHEAD BRIDGE
MINNESOTA CHANNEL
LAKE
SUPERIOR
SUPERIOR BAY
MINNESOTA POINT
SUPERIOR ENTRY
ALLOUEZ BAY
SUPERIOR
SCALE IN FEET

5. Discussion

The improvements planned for Silver Bay, Minnesota, should have no adverse impacts on fish or wildlife in or near the harbor.

6. Recommendations

The recommendations applicable to Silver Bay are those listed for the Great Lakes Basin, Part F.

B. Duluth-Superior, MN and WI

1. Description of the Area

The Duluth-Superior Harbor is located at the southwestern tip of Lake Superior. The City of Duluth, on the west side of the harbor, is in St. Louis County, Minnesota. Its neighbor city, Superior, is on the east side of the harbor, in Douglas County, Wisconsin. The harbor has 50 miles of total lake frontage and 17 miles of dredged channel areas. Covering an area of 19 square miles, the harbor consists of Superior Bay, St. Louis Bay, and Allouez Bay (See project area map).

Two peninsulas in line define the outer harbor Superior Bay area. Minnesota and Wisconsin points form an outer barrier ten miles long between the two cities which con-

stitutes the longest freshwater bay-mouth bars in the world. These sand and gravel points protect the harbor from Lake Superior, forming the Duluth Basin and Allouez Bay at the northern and southern ends of the harbor, respectively. Entrances to the harbor are located at either end of Minnesota Point.

The inner bars, Rice's Point and Connor's Point, separate the outer harbor from the inner harbor basin. This inner basin encompasses St. Louis Bay.

The entire Duluth-Superior Harbor area is characterized by shallow water depths and a naturally irregular shoreline that has been greatly modified by dredging and filling. With the exception of Allouez Bay, portions of the harbor sides of Minnesota and Wisconsin Points, and several small dredge spoil islands, practically all of the outer harbor has been developed for storage and loading of various types of cargo. Most of this harbor is maintained at a project depth of 27 feet by annual Corps of Engineers maintenance dredging. Commercial slips and anchorage areas are maintained under contract with a private dredging company.

The inner harbor is heavily developed for commercial shipping. The 27-foot deep navigation channel is limited to north and south channels of 400-to 600-foot width and a 2,000-foot wide cross channel connecting the two. A few of the shallower, formerly developed areas have reverted to wetland vegetation. The end of the 27 foot channel marks the end of commercial development on the Superior side of

the St. Louis Bay, while commercial and industrial development on the Duluth Side continues several miles further into the upper end of the bay. Development in that area has been accommodated by construction and maintenance of a 23 foot channel by the Corps of Engineers.

Two rivers with permanent flow empty into the Duluth-Superior Harbor complex. The St. Louis River, with a drainage basin of 3,640 square miles and average discharge of 2,268 c.f.s., is the second largest Lake Superior tributary and the largest U.S. tributary. After dropping more than 550 feet in the lower 15 miles of its descent to lake level, the St. Louis flattens out to flow through more than 10 miles of nearly pristine estuary marked by an abundance of backwater areas, bays and beds of aquatic vegetation before entering the zone of scattered industrial development marking the upper reaches of the St. Louis Bay. Waters of the St. Louis River above the zone of industrial influence are fairly clear, yet stained slightly brown due to their high content of humic acids and related naturally-occurring organic compounds. Through most of its lower 23 miles, the St. Louis River forms the boundary between Minnesota and Wisconsin.

The Nemadji River, which flows into Allouez Bay at the southern end of the outer Duluth-Superior Harbor, is considerably smaller than the St. Louis. The heavy red clay load carried by the Nemadji is characteristic of the rivers of the red clay belt along the south shore. The Nemadji is a significant factor in harbor maintenance because of the great quantities of sediment it transports to the Bay each year.

The Duluth-Superior Standard Metropolitan Statistical Area (SMSA) had a 1970 total population of 265,350 persons, Duluth's population of 100,578 represents over 90 percent of the population of Minnesota's shoreline. The population of the city of Superior in 1970 was 32,237. Both cities are expected to undergo modest population declines by the year 2000, but the population of the SMSA is projected to remain fairly stable.

In 1969, the Duluth-Superior Harbor was the fifth busiest in the U.S. with total net shipments exceeding 46 million tons. By 1972 that figure had dropped to slightly over 37 million tons and by 1975 only 33 million tons of cargo left the harbor. The Duluth-Superior Harbor nevertheless contributes substantially to the economy of the area. About 2,500 to 3000 persons hold harbor-related jobs. The major cargoes to be loaded in the harbor include iron ore, taconite pellets, processed wood and paper products, grain and, most recently, western low-sulphur coal. The shipping of coal and taconite pellets is expected to increase substantially over the next few years even though total harbor tonnage may continue to fall.

To date, no areas within or adjacent to the Duluth-Superior Harbor or St. Louis River estuary have been officially designated as unique areas or set aside as state or national parkland. However, the city of Superior owns and has designated several thousand acres of undeveloped land along the Wisconsin side of the upper St. Louis Bay as city forest. To our knowledge, the land will be retained for public

recreation. Fourteen acres on the south end of Barker's Island, a dredge spoil island located in Superior Bay adjacent to the city of Superior, have been set aside as a bird sanctuary and will be managed to promote shorebird use. Part of these presently undeveloped public lands may be used for spoil disposal in the future.

The Minnesota Department of Natural Resources has been examining the possibility of designating the St. Louis River, from its source to approximately 30 miles upstream of the Duluth-Superior Harbor, a State Wild and Scenic River.

Because of the aesthetic, recreational and wildlife value of the St. Louis River estuary combined with its proximity to a major population center, the Metropolitan Interstate Commission, a regional commission representing local governments and port authorities, has been working on a plan which would allow for preservation of major portions of the estuary for aesthetic and educational purposes.

Six major industries, including paper mills, an oil refinery, and a steel mill, have until recently discharged untreated or inadequately treated wastes into the lower 20 miles of the St. Louis River. In addition, the discharges of eight municipal treatment plants and the bilge, ballast and sanitary wastes from an unknown number of ships at the 39 major docking facilities in the harbor have severely polluted the waters of the St. Louis River and Duluth-Superior Harbor making them abnormally eutrophic.

In 1972, the Minnesota State Legislature authorized creation of the Western Lake Superior Sanitary District and provided funds for construction of a regional waste treatment facility in Duluth. The facility, which began operation in September 1978, provides secondary treatment with phosphorus removal for five of the six industrial discharges and all eight municipal treatment plants mentioned previously. This should greatly reduce nutrient loading and chemical pollution occurring in the St. Louis River and harbor area. We know of no plans to more closely control vessel discharges. While water quality is expected to improve dramatically in a relatively short period of time, the effects of toxicants and nutrients already buried in the river and harbor sediments are expected to adversely affect water quality for a number of years. It is expected that incoming cleaner river sediments will eventually bury polluted sediments to a depth where C.O.D., particularly in the river, will be insignificant if left undisturbed.

2. Description of the Project

The plan of development for winter navigation in the Duluth-Superior Harbor includes the placement of 10 bubbler systems at various locations within Superior and St. Louis Bays, the installation of six permanant navigational aids, the operation of a commercial icebreaking tug within Superior and St. Louis Bays, and the proposed construction of mooring facilities to accommodate a 140-foot Coast Guard icebreaking vessel to be used on the open lake.

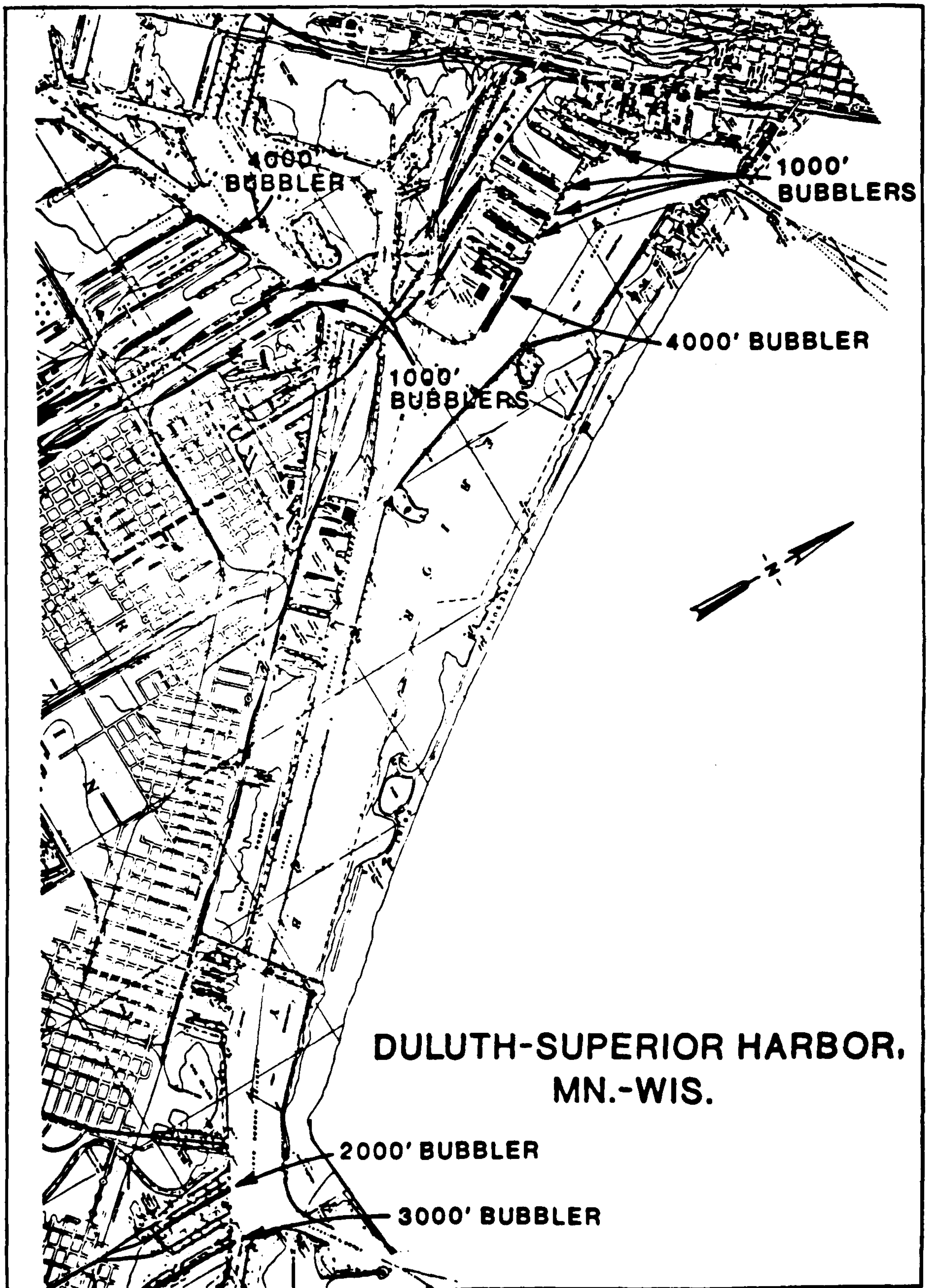


FIGURE II-B-2-1

The bubbler systems, ranging in length from 1000 to 4000 feet, would all be placed near the edge of the dredged 27-foot channel within narrow slips adjacent to loading piers (Figure II-B-2-1). In two cases, the bubblers would extend out past the outer end of the slips and follow the edge of the main navigation channel for approximately 2,000 feet. The bubblers would be held in place by wire approximately four feet off the bottom and would operate under the minimum pressure needed to produce bubbles along their full length.

The six navigational aids will consist of steel towers, with lights, placed on pilings at the edge of the 27-foot channel at strategic locations within the harbor. All would be constructed over water a considerable distance from the shoreline.

Ownership and berthing area of the commercially-operated icebreaking tug has not been identified. A berthing facility may need to be constructed.

The U. S. Coast Guard, located on Minnesota Point, presently operates a 180-foot buoy tender on icebreaking and other missions. Berthing facilities at the Coast Guard mooring area do not appear adequate to accomodate a second large icebreaking vessel. We therefore presume that berthing facilities would have to be constructed elsewhere.

3. Fishery

a. Without the Project

Thirty-three species of fish have been collected in fish surveys of the Duluth-Superior Harbor and St. Louis River estuary in recent years. The only game species present in significant numbers are northern pike, walleyes and yellow perch. Major forage fish include bullheads, spottail shiners, emerald shiners and juvenile perch, white and longnose suckers, and rainbow smelt. Water quality, including water temperatures and oxygen concentrations, all but preclude the use of the harbor and the lower St. Louis River by salmon or trout during the summer months. However, rainbow and brown trout as well as chinook salmon spawn in the Nemadji River system and are occasionally found in the harbor during early spring.

The yellow perch is the most abundant fish species in the harbor and estuary areas. The perch and northern pike are fairly well distributed throughout the shallower water areas The St. Louis River estuary, with its abundance of shallow, vegetated habitat, provides spawning habitat for the yellow perch and northern pike as do various other locations in Allouez Bay and the shallow areas around several dredge spoil islands in the outer harbor. Both yellow perch and northern pike, apparently able to contend with the low dissolved oxygen levels, remain in shallow areas of the harbor throughout the winter.

The walleye, an important sport fish, appears to spend late summer, fall and winter off the Wisconsin shore in Lake Superior. Recent unpublished studies indicate that tremendous numbers of walleyes begin entering the harbor in early March on their spawning run 20 miles up the St. Louis River to the first rapids. When individual fish have finished spawning, usually by late April, they return to Superior Bay where they spend the next two to three months feeding on the abundant forage fishes. Particularly heavy concentrations of adult walleyes are found during that period in the shallow waters around Barker's Island, near the Nemadji River mouth and in Allouez Bay. By mid-July, the majority of walleye adults have returned to Lake Superior. Walleye fry drift down to the lower harbor area shortly after hatching and spend most of the summer and fall within the harbor.

Other Lake Superior fish species entering the harbor or St. Louis and Nemadji Rivers for spawning include rainbow smelt, longnose suckers, white suckers, silver redhorse and burbot. The latter species is found only in early winter in the lower Nemadji, where it apparently spawns. As was mentioned earlier, poor water quality is suspected of playing a large role in the reduced use of the harbor by a number of important sport fishes. Water quality of the harbor and river is expected to undergo marked improvement since the new regional waste treatment facility has begun operating. Fishery managers

are optimistic that the entire harbor fishery, particularly several of the more desirable sport fishes, will respond positively to the improved water quality.

In addition to the setting of season dates, bag limits and, in certain cases, minimum size limits, the state of Wisconsin has a chinook salmon stocking program on the Nemadji River. In anticipation of great future fishing demand in the harbor area once water quality begins to improve, Wisconsin Department of Natural Resources (DNR) and the University of Wisconsin-Superior are conducting in-depth fish population assessments and surveys to determine the extent of the fishery and its use of the harbor-river system. The end result of the above studies would be the recognition and protection of especially valuable fish nursery and spawning areas.

A 1975 summer creel census of the Duluth-Superior Harbor and lower St. Louis River by the Wisconsin DNR resulted in an estimate of approximately 25,000 angler trips annually in all harbor waters (excluding Minnesota shore fishermen). Two-thirds of that fishing pressure took place in the outer harbor - Allouez Bay area. Estimated total harvest was 2,797 walleyes, 2,226 northern pike 1,362 bullheads, 650 yellow perch and 111 miscellaneous fishes. An extremely limited winter ice fishery is currently taking place on Allouez Bay. Yellow perch are taken in fair numbers by the few fishermen who venture out. On a few occasions during

past winters, the total oxygen demand of sediments has severely reduced dissolved oxygen levels by late winter, resulting in large fish kills.

Due to the polluted nature of their environment, fish in the harbor and lower St. Louis River (but not in the Nemadji River or Allouez Bay) are reported to have an unpleasant odor and taste, and many are simply caught for sport and released. With operation of the regional wastewater treatment facility, this problem is expected to decrease with the improvement in water quality. Due to the dubious eating qualities of harbor fishes and the proximity of Duluth and Superior residents to higher quality lakes and rivers, the Duluth-Superior Harbor and St. Louis River fishery is grossly under utilized. With anticipated improvements in harbor water quality and a "harbor awareness" campaign by the two cities, fishery managers are looking forward to a manyfold increase in fishing effort and harvest in future years with no damage to the fishery resource.

About a dozen commercial fishermen, operating out of the Duluth-Superior Harbor, fish for rainbow smelt on a seasonal basis in the lake. Nearly all of the 3 million-pound 1977 Lake Superior commercial smelt harvest came from Duluth-Superior offshore waters. The value of that catch was in excess of $91,000. The Nemadji River and other small streams entering the Duluth-Superior Harbor make significant contributions to smelt recruitment in the western Lake Superior

Basin. As water quality of the St. Louis River improves, it may also develop runs of smelt and other commercially valuable species.

b. With the Project

The bubbler systems are expected to produce minimal, if any, adverse environmental impacts. The placement of six all-weather aids to navigation at the edges of navigation channels will produce some short term turbidity and resuspend some polluted sediments. This would have a small short-term adverse impact on water quality and possibly cause the death of benthic organisms in the immediate vicinity of tower construction. Vessel activity in the harbor could resuspend polluted sediments. Berthing facilities could displace habitat, require dredging and destroy benthos.

4. Wildlife

a. Without the Project

The harbor area and St. Louis River estuary are best noted for the wide variety of waterfowl, shorebirds, gulls, and terns that nest or pass through the area. It has been stated by prominent ornithologists that Minnesota Point in the Duluth-Superior Harbor is the

best place in Minnesota to observe birds. A study by the University of Minnesota-Duluth identified 236 species of birds using the harbor in 1976-77; in May of 1977, 154 species were counted in the area in one day. The reasons for this phenomena are several, but one of the major ones is the diversity of bird habitat in the general area. Habitats available include shallow water marshes, mud flats, tree and sand-covered islands, sand dunes, sand beaches and rocky points.

Colonial nesting birds found throughout the summer in the harbor area include ring-billed gulls, common terns, herring gulls, piping plover, black terns, and great blue herons. The latter nests in a large rookery on a point in the St. Louis River estuary. Nesting waterfowl include mallards, wood ducks, blue-winged and green-winged teal and Canada geese. Game birds found in the area include ruffed grouse and the ring-necked pheasant. Raptors which nest locally include the great horned owl and American kestrel. Migratory birds make heavy use of the harbor area in spring and fall. Of particular interest is the fact that one of the largest fall concentrations of raptors in North America passes through the area.

Relatively few birds are known to spend the winter in the harbor area. Among those that do are the snowy and great horned owls, which feed on pigeons, rats,

and mice that concentrate around grain elevators on Conner's Point. The pheasant is also common throughout the winter in association with the grain elevators. A small flock of common goldeneye and common mergansers winters in water kept open by discharge from a power plant located about two miles upriver from the turning basin in St. Louis Bay.

The St. Louis estuary above St. Louis Bay and Allouez Bay receive more wildlife use than other parts of the harbor area. Aquatic mammals such as beaver, mink and muskrats are fairly common in this area.

Migratory waterfowl are taken on the Wisconsin side of the St. Louis River estuary upriver of the city limits of Superior. We presume that ruffed grouse are also taken in the adjacent forested areas. The Minnesota portion of the estuary is within the city limits of Duluth and all hunting is banned.

Federally threatened or endangered birds that live in or pass through the Duluth-Superior Harbor area include the bald eagle and the Arctic peregrine falcon. Efforts to establish the American peregrine falcon along the north shore of Lake Superior are forthcoming.

The only threatened or endangered mammal in the harbor or estuary area is the eastern timber wolf which is classified as threatened in Minnesota and endangered in Wisconsin.

b. With the Project

We do not forsee significant direct adverse impacts on the species composition, habitat use, management practices or harvest of wildlife caused by navigation season extension. We have been provided too little information with regard to structural details of navigational aids planned for installation, their method of installation and berthing facilities for an additional icebreaker to make a meaningful analysis of the impacts of those activities on wildlife. The comments made with regard to those program components are, therefore, deliberately general and subject to refinement at a future date. Also, they do not respond to secondary impacts, such as industrial development.

5. Discussion

Berthing facilities will probably need to be developed for a commercial icebreaking tug and 140-foot Coast Guard vessel. Dredging access channels and mooring facility areas will destroy benthos and reduce shallow water fish habitat. Alternative sites have not been identified making it impossible to assess the effects of this proposed development.

We are seriously concerned with the movement of deep draft and high powered vessels through the harbor under heavy ice conditions. Studies conducted in the Duluth-Superior Harbor have shown that commercial vessels moving at even slow speed cause tremendous resuspension of bottom sediments throughout the entire channel cross-section. As was discussed earlier, the sediments of the lower St. Louis River and Duluth-Superior Harbor possess a high combined biochemical oxygen demand (B.O.D.) and chemical oxygen demand (C.O.D.)

as a result of the many years those waters have served as dumping grounds for industrial and municipal effluents. It is anticipated that high oxygen demand in the sediments will continue to be a problem for several years after water quality in the system improves.

Winter oxygen depletion in the harbor has resulted in large fish kills without resuspension of these polluted sediments by vessel traffic. With large numbers of vessels moving throughout the harbor area during the period of ice cover and the attendant resuspension of formerly buried oxygen demand-carrying sediments, we are concerned that the accessibility of those sediments to the water column might be so greatly enhanced that the cumulative effects of repeated agitation and resuspension of bottom sediments in and adjacent to the navigation channel may cause near total depletion of oxygen in the outer harbor. If these effects are widespread, it could prove disastrous for fish, even though nearly all wintering fish are found well out of the existing navigation channels in water less than 15 feet deep.

Dissolved oxygen problems could also be aggravated if cargoes of hazardous materials, which possess a high oxygen demand, are spilled in the harbor.

The only present winter sport fishery occurs on Allouez Bay. This is due to a combination of factors. First, Allouez Bay is removed from sources of polluted effluent. Therefore, it is likely that it maintains higher dissolved oxygen concentrations than other parts of the harbor, thus

attracting and holding more fish, particularly yellow perch. Secondly, the fish taken there do not have an objectionable taste for the same reason. Thirdly, Allouez Bay is isolated from winter shipping and maintains a stable ice cover. The instability of the ice cover for a distance of several hundred yards on either side of vessel tracks will likely deter the future development of winter ice fisheries in the outer harbor or in St. Louis Bay.

6. Recommendations

The following recommendations supplement those listed previously for the Great Lakes Basin, Part F.

(1) The relationship between vessel traffic and spills of hazardous materials in the Duluth-Superior Harbor and dissolved oxygen concentrations should be investigated by persons or agencies expert in water quality problems.

(2) If studies show that increased vessel traffic and/or accidental spills significantly lower dissolved oxygen levels in the harbor, a plan should be developed in concert with the Minnesota Pollution Control Agency and Minnesota Department of Natural Resources, Wisconsin Department of Natural Resources, Environmental Protection Agency and U. S. Fish and Wildlife Service to mitigate and/or compensate that effect.

C. Ashland, WI

1. Description of Area

Ashland harbor is located at the head of Chequamegon Bay on the south shore of Lake Superior at Ashland, Ashland County, Wisconsin. It is separated from the Lake Superior by a low sand spit, 7 miles in length, called Chequamegon Point. Chequamegon Bay has an opening to Lake Superior which is about 2 miles wide along the western shore. To the north of this opening are the Apostle Islands which protect the entrance from lake storms. A portion of the islands have been designated as a National Lakeshore.

The existing Federal project consists of a west channel 20-21 feet deep and an east basin 25-27 feet deep, and an 8,000-foot breakwater. Commercial traffic consists primarily of limestone, coal, and lignite. Traffic amounted to 333,555 tons in 1975.

A water quality study of the Wisconsin waters of Lake Superior was conducted by the Wisconsin Department of Natural Resources during the summer of 1968. This survey revealed that Chequamegon Bay was showing signs of water quality deterioration in comparison to the outlying Wisconsin waters of Lake Superior.

Volatile solid samples, which are a measure that approximate the standing crop of algae, were almost 5 times greater in Chequamegon Bay (473 mg/1) than in outlying waters of Lake Superior (100 mg/1).

Inorganic nitrogen and soluable phosphorus levels in Chequamegon Bay were found to be .395 mg/1 and .018 mg/1 respectively. Both of these parameters exceed the critical levels for nuisance algae growth which are .30 mg/1 for inorganic nitrogen and .015 mg/1 for soluble phosphorus.

Dissolved oxygen concentrations of all areas studied in the Bay were found to be near saturation levels except at two stations near the American Can Company outlet.

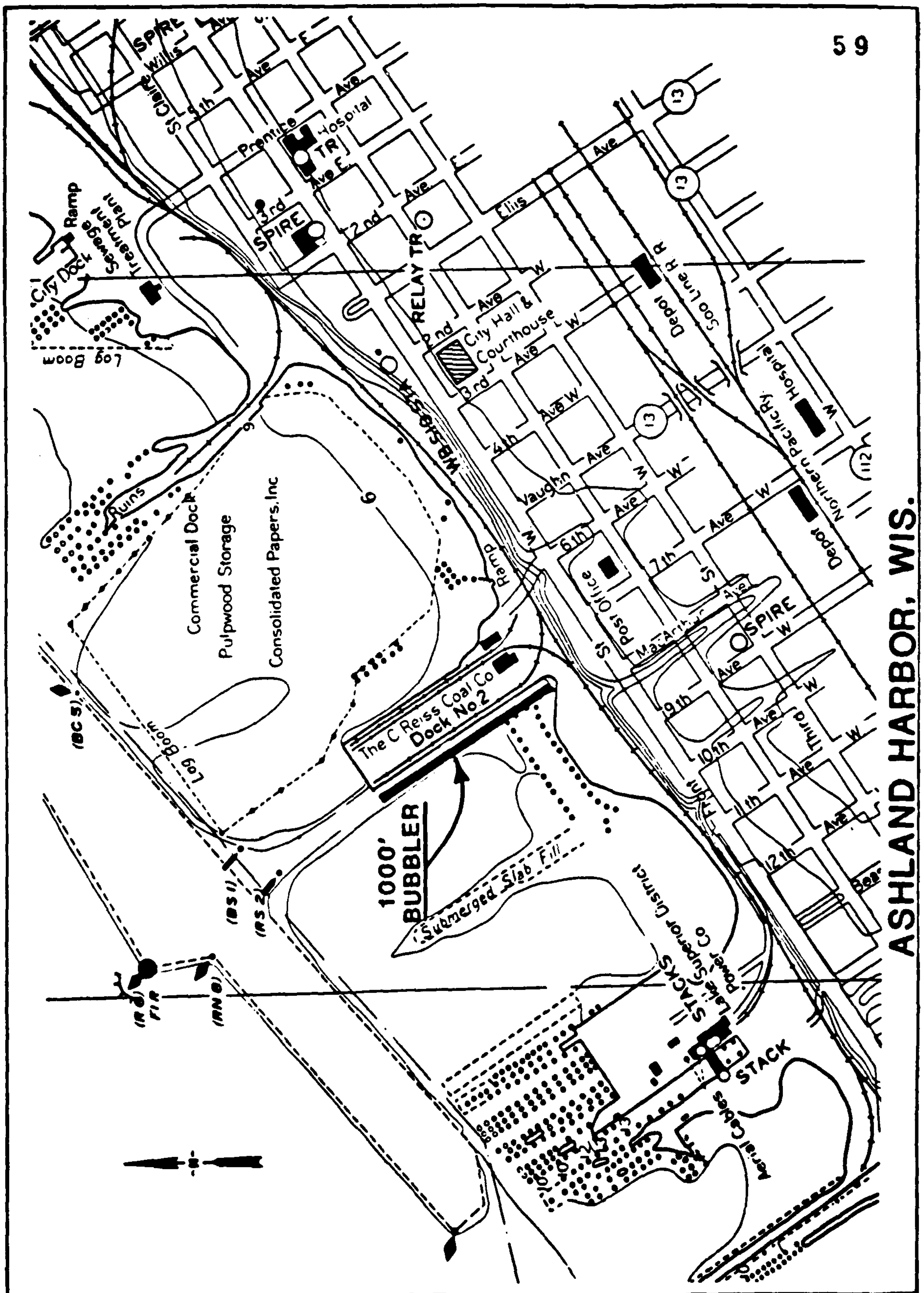
2. Description of Project

Present plans call for the installation of a 1000-foot bubbler line and the use of a high-powered icebreaking tugboat. (See Figure II-C-2-1)

3. Fish

a. Without the Project

The Wisconsin Department of Natural Resources studied the fish of Ashland Harbor during the spring and early summer of 1977. Forty species of fish were collected in the waters of the harbor.



FIGURE

II-C-2-1

Minimal spawning habitat was found in the harbor itself. Unsuitable bottom substrate is considered the limiting factor to fish spawning. Vast areas of the harbor substrate are littered with industrial waste from past and present use. Many areas are covered over with settled clay. Logs, slabs, wood bark and clay reduce chances for successful hatches because eggs laid on these oxygen demanding surfaces would likely be suffocated.

The Chequamegon Bay-Apostle Islands area has been and still is an area used by the cold water fishes, the trouts and whitefishes. Recent Pacific salmon introductions have also made chinook and coho salmon important.

Rainbow smelt do spawn in the early spring along most of the harbor shoreline although hatching success is probably reduced in most sections. Yellow perch, emerald shiners, mimic shiners, spottail shiners, trout perch, smallmouth bass, black crappie, pumpkinseed, and rock bass probably spawn in Ashland Harbor and elsewhere in Chequamegon Bay.

The Apostle Islands area shoals and shorelines were historically and still are used by lake trout and whitefishes for spawning. Recent lake trout spawning has been observed on the Gull Island and Michigan Island shoals.

The area of Chequamegon Bay northeast of the Ashland Harbor breakwater and extending northeast almost to Oak Point contains yellow perch which annually attract 2,000 to 5,000 ice fishermen.

The area known as the South Channel, between Madeline Island and Chequamegon Bay, is an area where 2,000 to 4,000 anglers seasonally ice fish for lake trout and also where commercial ice fishing is conducted. Commercial ice fishing also occurs along the east shore of Bayfield County, adjacent to the shipping lane between the shore and the Apostle Islands.

b. With the Project

Operation of the 1000-foot bubbler line is not expected to alter the composition or population of fish species in the area. The bubbler is not believed to affect major spawning or nursery areas. Vessel passage and icebreaking has been observed to be detrimental to fish and their habitats. Propeller wash and the pressure wave phenomenon create destructive currents which cause bottom erosion, sedimentation and turbidity. These high-velocity currents and sediment movements can kill fish and benthos.

Winter ship traffic could conflict seriously with sport and commercial fishing, especially in the South Channel area and in the water off the east shore of Bayfield County. Serious conflicts may arise on the Gull Island-Michigan Island closed area. This is a major lake trout, whitefish, and chub spawning area. These fish spawn in late fall and the eggs require a lengthly incubation period. Thus, the eggs and larvae of these species would be susceptible to disturbance during these critical life stages.

4. Wildlife

a. Without the Project

Because Ashland Harbor is on Chequamegon Bay and because the Bay has such a relatively narrow entrance, it is appropriate to consider wildlife within the Bay, as well as within the immediate vicinity of Ashland Harbor itself.

Two species of amphibians, the American toad and leopard frog, and one reptile, the painted turtle, have been reported to occur in the immediate vicinity of Ashland Harbor. Other species could also be expected to occur in the vicinity of Chequamegon Bay.

A list of mammals of the area would probably include many species of shrews and rodents such as cottontail, snowshoe hare, beaver, muskrat and porcupines; bats, coyote, red fox, black bear, raccoon, mink, weasels, striped skunk, otter, bobcat, and white-tailed deer.

Between 1975 and 1977 at least 210 species of birds were observed in the immediate vicinity of Chequamegon Bay. Approximately thirteen species nested in close association with the water.

In 1976 and 1977 there were four active bald eagle nests on Chequamegon Bay. The Wisconsin Department of Conservation has indicated that more intensive search would probably reveal additional nests.

Chequamegon Bay and its associated marshes and sloughs make it ideal for spring migratory waterfowl, waterbirds, and shorebirds and also provide nesting sites for summer waterfowl residents. The Kakagon Sloughs, at the mouth of the Kakagon River about 9 miles east of Ashland, represent excellent marsh habitat with human disturbance limited to that coming from people in boats or canoes.

The colonial nesting waterbirds, waterfowl and bald eagles are among the important birds of Ashland Harbor and Chequamegon Bay.

Waterfowl utilize Chequamegon Bay for breeding, resting, feeding, and wintering. Dabbling ducks such as blue-winged teal, mallard, and wood duck nest in the area while diving ducks would be the most common wintering species.

The bald eagles probably do not winter on Chequamegon Bay, but they return to the nests early in spring and may begin egg-laying in late March. The main food of the eagles would be fish and perhaps waterfowl that they might catch on open water areas.

The piping plover has apparently declined to very low numbers in the Upper Great Lakes. Long Island and Wisconsin Point may be the only places in Wisconsin where the species still nests. Human disturbance and habitat destruction are generally blamed for this species' decline.

b. With the Project

Mechanical destruction of benthos and newly hatched fish by ship propeller wash and ship wakes have been discussed. The wildlife impacts of this would be the reduction in food supply for those wildlife species that feed on benthos or fish or are secondarily dependent on them. Migrating and wintering diving ducks would have their food supply reduced. Waterfowl attracted to artificially maintained open water, but without adequate food, may not leave; if they do, they may be unable to find another protected area with food available at suitable water depths. Also, the nutritional state of migrating waterfowl in spring appears to be very important. Reproductive success may depend greatly on birds having adequate food in the pre-reproductive period of spring migration. If the food supply of these harbors is reduced by ships during the winter, it would tend to reduce their reproductive success in spring.

The impact of reduced benthos and fish life is not limited to waterfowl. Gulls, terns, ravens, crows, bald eagles, and terrestrial carnivores scavenge dead fish and actively pursue live ones. The gulls, terns and eagles absolutely require fish. An adequate food supply is essential if these birds are to continue nesting in the area.

Winter complicates clean-up efforts and a spill in Ashland Harbor or Chequamegon Bay should be expected to contaminate the shoreline. Oil, on the water or on shore, can get on bird plumage. Recent research indicates that even small amounts of oil from a bird's plumage can kill the embryos in eggs. Thus, even if the oil is not fatal to the individual bird it could reduce that bird's breeding success. The local impact of this could be severe for the ducks, shorebirds, gulls and bald eagles that feed and breed in the area.

The bubbler line could create open water areas and, as previously mentioned, waterfowl congregate in winter in areas that have both open water and some protection from wind and waves. Winter is a period of great stress for them due to scarce food supplies and increased energy requirements for body maintenance. Further stresses may result from the crowding and the unavailability of desirable habitat. In short, the birds wintering in the harbors are under a number of stresses. Additional expenditures of energy that have no return value will be required as birds flee oncoming ships. There will be additional forced movement to harbor and water areas where conditions are less favorable. It is certain, however, that additional stress will have a negative adverse impact.

5. Discussion

Vessel movement, particularly vessels breaking ice, may disturb adult fish so that under-ice movement is increased and wintering areas are changed. Little research has been done regarding vessel passage on fish movement in winter, but it could disrupt the significant South Channel sport and commercial fishery. Sport fishermen apparently maintain what they feel is a safe distance from the ship track and are reluctant to cross it until shipping ceases. Broken ice tracks to docks proposed for winter traffic would place added limits on where ice fishing could occur and when access by ice to other areas would be safe. Commercial fishing could be delayed or otherwise modified.

Wildlife impacts will be reduced if impacts on benthos, fish eggs, and young fish are avoided. Likewise, the previous discussion of impacts from spills and discharges from ships applies. If spills and discharges are minimized, wildlife impacts will be less.

The problem of artificially opened water attracting more waterfowl than the food supply can support could be reduced by regulating bubbler operation. If the water is allowed to freeze before beginning bubbler operation, and operation only thins the ice cover, additional birds may not be induced to stay in Ashland Harbor.

The proposed activities might have an impact on the bald eagle, a species on the Federal Government's list of threatened wildlife in Michigan. Spills into the harbor in winter

could contaminate the fish and water birds which could then be eaten by the eagles and thus sicken or kill the eagles. Oil on the eagle's feathers could be carried to nests, penetrate egg shells and kill the embryos.

6. Recommendations

The following recommendations supplement those listed previously for the Great Lakes Basin, Part F.

(1) Bubblers should not operate until stable sheet ice has formed. No additional open water should be created.

(2) Areas of ice influenced by bubbler operation should be clearly marked to warn winter recreationists of possible unsafe ice.

D. Marquette, MI

1. Description of Area

Marquette Harbor is located at the City of Marquette, Marquette County, Michigan, on Lake Superior's south shore. Navigation improvements are a 70-acre dredged area 27 feet deep protected by a breakwater approximately 4,500 feet long. Total protected area is 350 acres.

The average annual commerce for the period 1970-1974 was approximately 1,010,600 tons, consisting primarily of the receipt of coal, petroleum and slag. Iron ore was last shipped from Marquette in 1971.

Marquette Harbor water quality is highly variable and can change rapidly, but generally meets State water quality standards. Dissolved oxygen levels are generally at or near saturation in all areas sampled. The pH of water samples in Marquette Harbor is slightly alkaline, ranging from 7.0 to 8.2. Turbidity values for the harbor are generally low. Sediments in Marquette Harbor consist mainly of sand, silt, and clay and are classified as non-polluted by the U. S. Environmental Protection Agency.

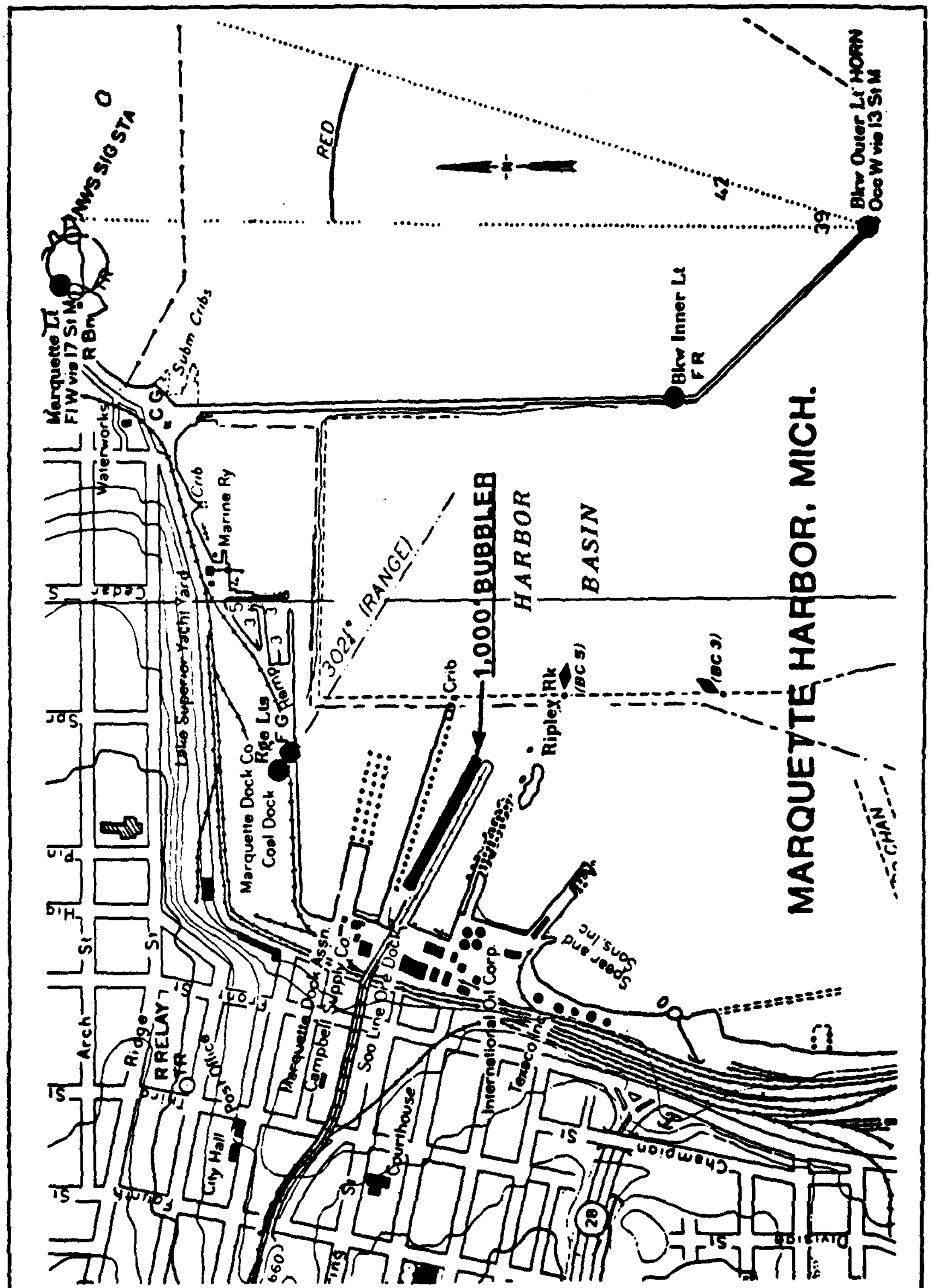
2. Description of Project

A 1,000-foot bubbler adjacent to the Soo Line ore dock is the only improvement proposed for Marquette Harbor (Figure II-D-1). The bubbler would be held in place by wire approximately four feet off the bottom and would operate under the minimum pressure needed to produce bubbles along its entire length.

3. Fish

a. Without the Project

The most common fish species of the harbor are the spottail shiner, mottled sculpin, slimy sculpin, rainbow smelt, round whitefish, and white sucker. Among the fish known to be present (See Table IV. D. 3. a. 1), several are sufficiently abundant to receive considerable attention from sport fishermen. Lake trout are caught within the harbor, mostly during May, June, September, October, and November. Coho and chinook



MARQUETTE HARBOR, MICH.
1,000 BUBBLER
HARBOR
BASIN
302½° (RANGE)
RED
Bkw Outer Lt HORN
Occ W vis 13 St M
Bkw Inner Lt
F R
Marquette Lt
Fl W vis 17 St M
R Bn
NWS SIG STA
Subm Cribs
Waterworks
Crib
Marine Ry
Lake Superior Yacht Yard
Rge Lts
F G
Ramp
Marquette Dock Co
Coal Dock
Ripley Rk
Marquette Dock Assn
Campbell Supply Co
Soo Line Ore Dock
International Oil Corp
Texaco Inc
Spear and Sons Inc
Courthouse
City Hall
Post Office
R RELAY
Ridge
Arch
St
Champion
CHAN

FIGURE II.D. 1

TABLE II. D. 3. a. 1

Fishes of Marquette Harbor and Vicinity

COMMON NAME
Sea Lamprey
Cisco or Lake herring
Lake whitefish
Bloater
Pink salmon
Coho salmon
Chinook salmon
Round whitefish
Rainbow trout
Brown trout
Brook trout
Lake trout
Rainbow smelt
Northern pike
Carp
Emerald shiner
Spottail shiner
Longnose sucker
Burbot
Ninespine stickleback
Smallmouth bass
Johnny darter
Yellow perch
Walleye
Mottled sculpin
Slimy sculpin
Spoonhead sculpin

salmon are intensively sought from February through June, September and October. The northern pike fishery is limited, but they attain large size; the fishery is most productive during the winter months. Rainbow, brown and brook trout are caught throughout the year and often are taken incidentally by salmon or lake trout fishermen. Lake whitefish, lake herring, lake trout, suckers and burbot are commercially taken in the waters outside the harbor.

Lake trout use the rocky areas in the harbor for spawning. The DNR has trap-netted them in late October and early November to obtain eggs for hatchery propagation. In the harbor, the eggs hatch in March or April and the young seek deeper water within one month.

Evidence that lake herring, lake whitefish, and round whitefish use Marquette Harbor for spawning was obtained by Battelle Laboratory personnel in December 1972. They found these species' eggs in the stomachs of burbot and round whitefish captured in the harbor. Personnel of the Michigan DNR have captured mature ripe lake whitefish, lake herring, and round whitefish in the harbor in late fall when spawning would normally be taking place.

We presently know of no Federally endangered or threatened aquatic organisms that live in or near Marquette Harbor.

b. With the Project

The installation of a 1,000-foot bubbler adjacent to the Soo Line ore dock will result in the loss of a small amount of bottom habitat to placement of anchors. It is not presently known if lake trout, lake whitefish and lake herring spawn in the exact location of anchor installment. Disturbance of the sediment during bubbler installation would have an adverse effect on fish eggs and larvae in the immediate area. Operation of the bubbler is not believed to have any adverse effects on fishery resources.

4. Wildlife

a. Without the Project

Mammals found in the Marquette Harbor area are those of a semi-industrialized and partially wooded environment. The eastern cottontail, short-tailed weasel, raccoon, deer mouse, red-backed vole, eastern and least chipmunk, gray squirrel, and shrews are commonly found in the area. Mammals less frequently observed are the striped skunk, muskrat, snowshoe hare, meadow mouse, porcupine, and woodchuck.

Various species of birds have been observed in and around Marquette Harbor. The Dead River serves as a winter feeding ground and spring nesting area for a variety of waterfowl.

In winter, Marquette Harbor hosts ducks, geese and gulls. Occasionally bald eagles and frequently snowy owls make winter use of the area. The bald eagle is presently on the Federal "threatened" list in Michigan. Other waterbirds may also be seen occasionally in the harbor.

b. With the Project

We anticipate no change in wildlife species composition, habitat use, management or harvest as a result of installation and operation of a 1,000-foot bubbler in Marquette Harbor.

5. Discussion

The effects of bubbler installation on lake trout, lake whitefish and lake herring eggs and larvae are believed to be minor. Studies can be conducted to determine these effects quantitatively. If the studies show adverse effects, they could be lessened by performing the work when eggs and larvae of important species are not present, and by modifying the bubbler location.

Studies could also be conducted to determine the amount and location of winter bird use in Marquette Harbor.

Information obtained from these studies could be compared with similar information for Presque Isle Harbor and a determination made as to which harbor would have the least adverse environmental impacts from extended navigation.

Since the harbors are only three miles apart, it seems that one harbor, not both, could serve the needs of the community and the shipping industry in winter.

6. Recommendations

The following recommendations supplement those listed previously for the Great Lakes Basin, Part F.

(1) Conduct a study to determine the magnitude, spatial and temporal aspects of fish spawning in the area of the proposed bubbler. The results of this investigation could be used to modify the location and perform the work during a specific time period, if necessary.

(2) Conduct a study to determine the amount and location of winter bird use in Marquette Harbor.

(3) Conduct similar studies in Presque Isle Harbor, if the information is not available, to compare environmental impacts of extended navigation.

(4) Evaluate the information in concert with the Michigan Department of Natural Resources, U. S. Environmental Protection Agency and U. S. Fish and Wildlife Service to determine in which harbor the least, over-all adverse environmental impact will result.

(5) Recommend either Marquette or Presque Isle Harbor, for extended navigation based on the above determination.

E. Other Harbors

1. Taconite

Description of the Project Area

Taconite Harbor is a community of less than 200 persons located in Cook County, Minnesota, on the north shore of Lake Superior approximately 80 miles northeast of Duluth, Minnesota. The economy of Taconite Harbor is derived almost exclusively from operation of the Erie Mining Company's taconite ore shipping facilities and electric generating plant located in the Harbor.

The private harbor consists of a straightened stretch of shoreline protected to the east by a rock rip-rap breakwater and to the south by two small islands joined by a breakwater of similar composition perpendicular to the eastern breakwater. Entrance to the harbor is from the southwest, parallel with the shoreline. Ships exit the harbor at its eastern end, through an opening between the two breakwaters. Depths of less than 30 feet are common from the harbor entrance to the loading area, necessitating maintenance dredging on a periodic basis.

Shipping facilities at Taconite Harbor consist of a single dock used for unloading coal and loading taconite pellets on vessels bound for the steel mills on the lower Great Lakes.

The topography, climate and vegetation of the Taconite Harbor area are typical of that described for the northern Lake Superior sub-basin. Topography is characterized generally by a land water interface of gravel beaches interspersed with rocky bluffs. Vegetation consists primarily of mixed second-growth stands of aspen, birch, white spruce, balsam fir and pine. The lake exerts a strong micro-climate influence on the immediate shoreline, resulting in cooler summers and warmer winters compared to areas several miles inland.

The large number of State Parks established along the northern shore of Lake Superior attest to the uniqueness of that area. Temperance River State Park, located approximately five miles northeast of Taconite Harbor, received 139,248 visitors in 1977. Visits to all 11 Minnesota State Parks along the lake in 1977 totalled 1,651,000.

The bottom sediments of Taconite Harbor have not been sampled by the Environmental Protection Agency or Corps of Engineers, consequently their composition is unknown. Possible sources of water pollution include spillage of taconite and coal during loading and unloading, leaching of compounds from coal and taconite stockpiles, and pumping of bilge, ballast and sanitary wastes by vessels into the harbor.

Plan of Development

Taconite Harbor was one of seven Lake Superior harbors to be studied for the purpose of assisting winter navigation to and at this harbor. No improvements are proposed.

Fish and Wildlife

The fishery of Taconite Harbor has not been studied extensively. However, an impingement-entrainment study of the power plant intake system conducted by Erie Mining Company in 1976 identified nine fish species using the harbor. Smelt made up over 98 percent of the total collection which consisted additionally of burbot, walleye, lake trout, bullheads, lake herring, ciscos, alewives, and stickleback minnows. Undoubtedly, northern pike, suckers and other salmonid species also visit or reside in the harbor.

The Erie Mining Company does not allow sport fishing along the harbor shoreline at the present time and is not expected to change its policy. No commercial fishing takes place in the harbor.

For a description of wildlife found in the Taconite Harbor area, see the description of wildlife in the Lake Superior portion of the report. Wildlife populations are not expected to change significantly in the foreseeable future. No hunting is allowed in the project area, and this situation is not expected to change in the future.

2. Two Harbors

Description of the Project Area

Two Harbors is a community of about 4,400 persons located in Lake County, Minnesota, on the north shore of Lake Superior approximately 27 miles northeast of Duluth, Minnesota. The economy of the area is derived from a diversity of sources, including heavy and light manufacturing, logging, commercial and service-related businesses, tourism and harbor shipping.

Harbor facilities, consisting of three iron ore loading docks, have been constructed in a relatively shallow natural bay (Agate Bay) dredged to a project depth of at least 28 feet. The private harbor is protected from Lake Superior storms by concrete breakwaters constructed on either side of its entrance.

The area's topography, climate and vegetation are typical of that described for the northern Lake Superior sub-basin. Topography is characterized generally by a land - water interface of gravel beaches interspersed with rocky bluffs. Vegetation consists primarily of mixed second-growth stands of aspen, birch, white spruce, balsam fir and pine. The lake exerts a strong micro-climate influence on the immediate shoreline, resulting in cooler summers and warmer winters compared to areas several miles inland.

The large number of State Parks established along the northern shore of Lake Superior attest to the uniqueness of that area. Gooseberry Falls State Park, located approximately 15 miles northeast of Two Harbors, received 735,617 visitors in 1977. Visits to the 11 Minnesota State Parks along the lake in 1977 totalled 1,651,000.

Water quality of Two Harbors is classified as polluted by the Environmental Protection Agency. Compounds exceeding or approaching EPA limits for dredge sediments include zinc, total kjeldahl nitrogen (TKN), chemical oxygen demand (COD), oil, grease and lead. Anticipated future mandatory improvement in municipal and industrial discharges entering the harbor should bring about reductions in COD and TKN in bottom sediments.

Plan of Development

Two Harbors was one of seven Lake Superior harbors to be studied for the purpose of assisting winter navigation to and at this harbor. No improvements are proposed.

Fish and Wildlife of the Project Area

The fishery of Two Harbors harbor has not been studied extensively, but is probably representative of Lake Superior in general. Most Lake Superior trout and salmon species pass through the harbor periodically and can be caught from the more easterly breakwater during late summer and fall.

Undoubtedly several species of suckers and minnows reside in the harbor during the summer. Smelt, which spawn along the beach in April, are the only species known to spawn in the harbor. No endangered fish species are known to inhabit either harbor or lake. We would anticipate that, as salmonid populations continue to increase in size, a greater amount of breakwater fishing will take place in future years. The harbor presently supports no commercial fishery and none is expected to develop in the future.

For a description of wildlife found in the Two Harbors area, see the description of wildlife in the Lake Superior portion of the report. Wildlife populations are expected to remain fairly stable in the foreseeable future. No hunting is allowed in the project area and the situation is not expected to change in the future.

3. Presque Isle

Presque Isle Harbor, also known as the Upper Harbor, is a commercial and recreational port with approximately 3 miles north of Marquette Harbor but within the city limits of Marquette, Marquette County, Michigan. It is formed by a natural indentation in the shoreline just south of Presque Isle Point. Average annual commerce from 1970 through 1974 was 3,548,000 tons, primarily the shipment of iron ore.

The harbor area of Presque Isle is 1-1/2 miles long and 1/2 mile wide with natural depths of 20 to 40 feet. Presque Isle Point forms the northern boundary of this harbor and the mainland forms its western boundary. The harbor is protected on its east, or lakeward, side by the Federal breakwater and is open to Lake Superior from the south and southeast. The basin is 3,500 feet long, 27 feet deep, and 1,600 feet wide at its northernmost point.

Water quality is highly variable and can change rapidly in Presque Isle Harbor, but generally meets State water quality standards. Dissolved oxygen levels are generally at or near saturation in all areas sampled. The pH of water samples in Presque Isle Harbor is slightly alkaline, ranging from 7.0 to 8.2. Turbidity values for the harbor are generally low. Material dredged from the polluted portion of the harbor is considered unsuitable for open-lake disposal by the U. S. Environmental Protection Agency.

The plan indicates that the present bubbler system at some docks and waste heat discharged from the power plants are sufficient to keep Presque Isle Harbor open for shipping even in severe winters. Thus, no additional measures will be employed.

The most common fish species of the harbor are the spottail shiner, mottled sculpin, slimy sculpin, rainbow smelt, round whitefish, and white sucker. Among the fish known to be

present (See Table II.E.3. 1), several are sufficiently abundant to receive considerable attention from sport fishermen. Lake trout are caught within the harbor, mostly during May, June, September, October, and November. Coho and chinook salmon are intensively sought from February through June, and September through October. The northern pike fishery is limited, but they attain large size; the fishery is most productive during the winter months. Rainbow, brown and brook trout are caught throughout the year and often are taken incidentally by salmon or lake trout fishermen. Lake whitefish, lake herring, lake trout, suckers and burbot are commercially taken in the waters outside the harbor. Many people dip-net rainbow smelt during the smelt's spawning migration into the Dead River in late April and early May.

Lake Superior fish that use the Dead River for spawning include rainbow smelt, rainbow trout, suckers, yellow perch, northern pike, and sea lamprey in the spring. Coho, pink and chinook salmon; rainbow and brown trout use the river in the fall. Because of man-induced alterations of the lower Dead River and use of its water for cooling purposes by the Presque Isle Generating Station, reproduction from this spawning effort is probably limited. However, the suckers, smelt, and pink salmon enter the river in substantial numbers and their populations have not been sustained by planting of hatchery-produced fish. We believe their spawning efforts are successful.

TABLE II.E.3. 1

Fishes of Presque Isle Harbor and Vicinity

Sea Lamprey
Cisco or Lake herring
Lake whitefish
Bloater
Pink salmon
Coho salmon
Chinook salmon
Round whitefish
Rainbow trout
Brown trout
Brook trout
Lake trout
Rainbow smelt
Northern pike
Carp
Emerald shiner
Spottail shiner
Longnose sucker
Burbot
Ninespine stickleback
Smallmouth bass
Johnny darter
Yellow perch
Walleye
Mottled sculpin
Slimy sculpin
Spoonhead sculpin

Lake trout use the rocky areas in the harbor for spawning, including riprap around the water intake for Presque Isle Generating Station. The DNR has trap-netted them in late October and early November to obtain eggs for hatchery propagation. In the harbor, the eggs hatch in March or April and the young seek deeper water within one month.

Evidence that lake herring, lake whitefish, and round white-fish use Presque Isle Harbor for spawning was obtained by Battelle Laboratory personnel in December 1972. They found these species' eggs in the stomachs of burbot and round whitefish captured in the harbor. Personnel of the Michigan DNR have captured mature ripe lake whitefish, lake herring, and round whitefish in the harbor in late fall when spawning would normally be taking place.

We presently know of no Federal endangered or threatened aquatic organisms that live in or near Presque Isle Harbor.

Mammals found in the Presque Isle Harbor area are those of a semi-industrialized and partially wooded environment. The eastern cottontail, short-tailed weasel, raccoon, deer mouse, red-backed vole, eastern and least chipmunk, gray squirrel, and shrews are commonly found in the area. Mammals less frequently observed are the striped skunk, muskrat, snowshoe hare, meadow mouse, porcupine, and woodchuck.

Various species of birds have been observed in and around Presque Isle Harbor. The Dead River serves as a winter feeding ground and spring nesting area for a variety of waterfowl.

In winter, Presque Isle Harbor hosts roughly 100 ducks, 300-400 gulls, and a few Canada geese and mergansers. Occasionally bald eagles and frequently snowy owls make winter use of the area. The bald eagle is presently on the Federal "threatened" list in Michigan. The glaucous gull is considered a rarity in the Great Lakes area, but one or two are usually sighted in winter around Presque Isle.

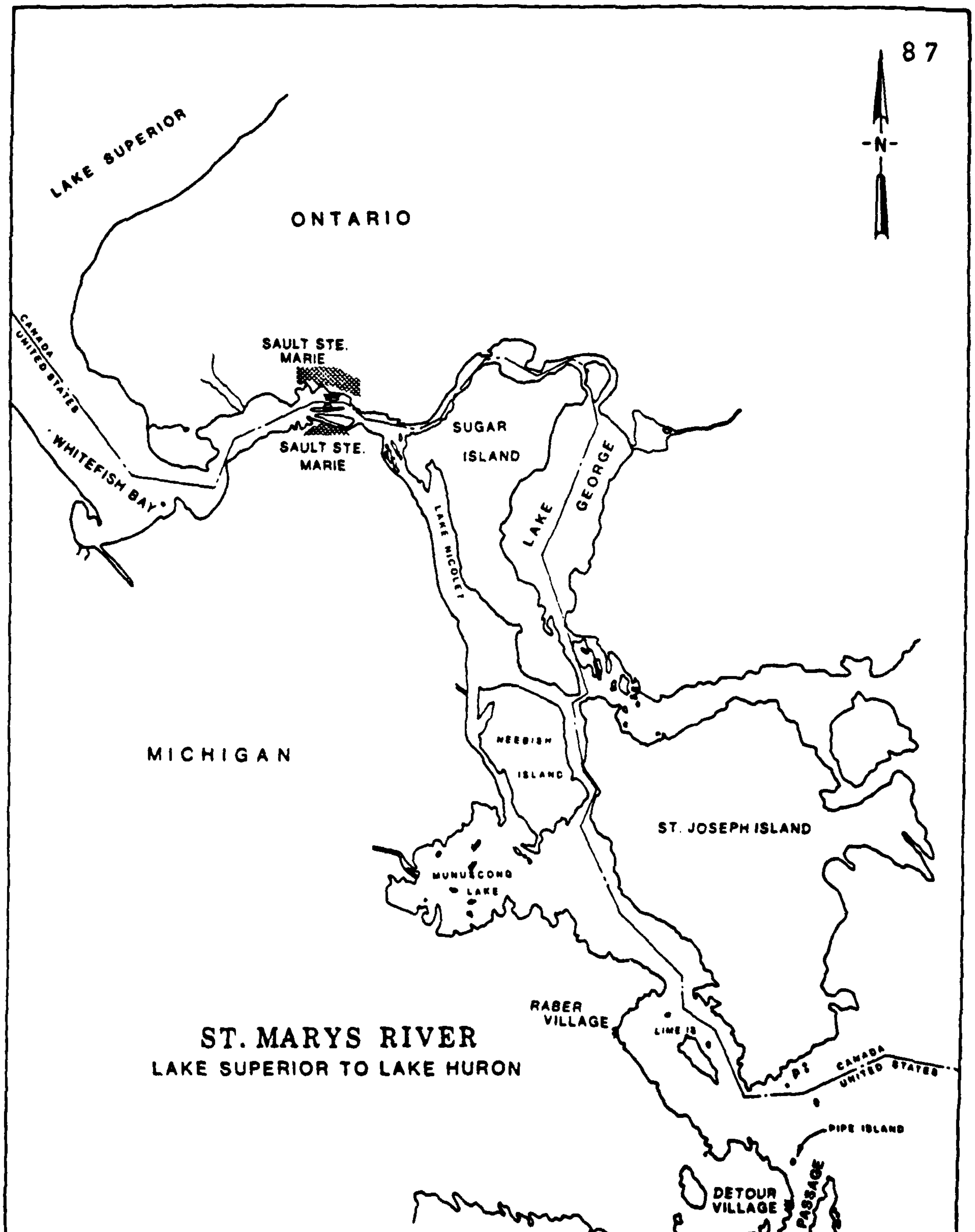
III. ST. MARYS RIVER (CONNECTING CHANNEL)

A. Description of Area

The St. Marys River is approximately 65 miles in length and is the outlet of Lake Superior to Lake Huron and the remaining Great Lakes. The St. Marys River drains 830 square miles of Canada and 170 square miles of the United States for a total drainage area of 1,000 square miles.

From its headwaters at Whitefish Bay to its mouth at Lake Huron, the St. Marys River descends approximately 22 feet. Most of this fall occurs about 14 miles downstream from Whitefish Bay at what remains of the historic St. Marys Rapids. Below the Rapids the river falls about 2 feet on its way to Lake Huron. The flow of the St. Marys River during the 74-year period between 1900-1973 has averaged 74,900 cubic feet per second (cfs) and ranged from a maximum of 127,000 cfs in August, 1950, to a minimum of 41,000 cfs in September, 1955, (Feasibility Study of Remedial Works in the St. Marys Rapids at Sault Ste. Marie, September, 1974).

The 65 mile long St. Marys River provides a natural boundary between the United States and Canada. It is bounded on the United States side by the eastern edge of Michigan's upper peninsula and on the Canadian side by the Province of Ontario. The river flows in a southeasterly direction constricting in some areas and enlarging in others and forming numerous shallow bays along its main course. Four large islands, namely Sugar Island, Neebish Island, St. Joseph Island and Drummond Island divide the river into several channels. These channels broaden out in several areas to form lakes. These lakes are Lake George, Lake Nicolet and Lake Munuscong. (Figure III-A-1).



ST. MARYS RIVER
LAKE SUPERIOR TO LAKE HURON

FIGURE III-A-1

Originally, the natural control for the outflow of the cold Lake Superior waters was a sandstone rock ledge located in the St. Marys River at the vicinity of Sault Ste. Marie. This rock ledge formed the head of the St. Marys Rapids which once spanned the entire width of the river. This rapid was well known at one time for its whitefish fishery. In the interest of commercial navigation, however, both ends of the Rapids were destroyed by the construction of locks that would permit vessel movement through the Rapids area. Later, the demand for hydroelectric power resulted in the construction of a Compensating Works Dam which was completed in 1921 above the Rapids. A section of the original Rapids still remains in the mid-portion of the river; however, as a result of the construction associated with navigation and power generation, the flow of water from Lake Superior is now completely regulated. In addition to this construction, the St. Marys River has a dredged channel almost throughout its entire length. The last channel deepening occurred in the early 1960's to a minimum depth of 27.5 feet low water datum (LWD) to allow for the passage of larger deeper draft commercial vessels. The width of this dredged channel varies from 300 to 1,500 feet. Spoil from the channel deepening project was dumped into numerous locations throughout the river system forming spoil islands in many cases.

In addition to the St. Marys Rapids, two other smaller rapids existed in the river which have been destroyed by the construction of the navigation channel. These were the Little Rapids at the head of Lake Nicolet and the Neebish Rapids in the West Neebish Channel.

The St. Marys River receives the well oxygenated high quality cold waters from Lake Superior, and with the exception of one reach, this high quality is maintained in the river. A long standing problem exists with the industrial and domestic discharges from the Canadian side. The Algoma Steel Corporation, the Abitibi Power and Paper Company, the Mannesman Tube Company, the Dominion Tar and Chemical Company and the City of Sault Ste. Marie, Ontario discharge either directly or indirectly into the river and seriously degrade the waters of the Canadian side. The Ontario Water Resources Commission, in cooperation with the International Joint Commission, conducted a biological investigation of the river in 1967. The report, titled "Biological Survey of the St. Marys River," indicates that above Algoma Steel, Mannesman Tube and the Dominion Tar and Chemical plants, which discharge very near to each other immediately above the Canadian Soo Locks, the water quality was good and the benthic communities were characterized by a wide variety of pollution intolerant species. Downstream from this point, however, the Canadian side is seriously degraded. The degradation continues at least 10 miles downstream into the north channel above Sugar Island and into Little Lake George. Pollutants discharged into the river include phenols, irons, cyanide, oil, wood fibers and particles, ammonia, napthalene and domestic sewage. The bottom fauna in this reach has been greatly reduced in diversity and is composed of pollution tolerant organisms. Some sampling sites of the 1967 survey were devoid of aquatic invertebrates.

The Canadian pollution has not greatly affected the American side of the river, however. Water quality is good and the river supports a well-balanced fauna with a wide variety of organisms.

The west channel of Sugar Island was also found to have a clean water environment similar to that found in the remaining downstream river to Lake Huron.

B. Description of Project

With the exception of a short distance below the Soo Locks and the Rapids, the St. Marys River freezes over during the winter beginning in December and lasting through March. The thick ice cover combined with the natural characteristics of the river such as rapid flow and narrow meandering bends hamper winter navigation. Several courses of action for preparing the river for winter navigation have been discussed and considered during the course of the demonstration program. The following discussion provides some insight into the range of alternatives.

Ice Navigation - Icebreaking assistance, vessel convoys and escort service was considered for the entire river system. Other alternative solutions were dusting, thermal ice suppression and air cushion bows on vessels.

Tight Turns - To allow long vessels to maneuver through tight meandering bends in the river air bubbler systems were considered at numerous locations. These turn locations are Birch and Brush Point Angle Courses at the head of the St. Marys River; at Angle Courses 5 and 6, 6 and 7, 7 and 8, 8 and 9, 9 and 10 of the Middle Neebish Channel; and at Lime Island Turn. Other alternatives considered were an ice clearing device, dusting, flow diverters, icebreaking assistance and minimum vessel ice operation capabilities.

Ice Jams and Flooding - The build-up of ice jams from moving sheets and broken ice can cause navigation problems and flooding. Three locations in particular have been identified: the Little Rapids Cut at the head of the west channel along Sugar Island, the West Neebish Channel along Neebish Island, and near Pipe Island upstream of the Drummond Island ferry crossing. A number of alternative solutions were developed to surpress the formation of, or control the movement of this ice. At Little Rapids Cut, floating log ice booms and ice stabilization islands were considered for construction. Other alternative measures included an air bubble-flusher system at the ferry dock; preventative icebreaking; diversion of the American Soo sewage treatment plant, the Soo Edison, and the Canadian wastewater discharges to Little Rapids Cut and other potential ice jam areas; and a network of nylon anchored to the shore and frozen into the ice cover to anchor the ice. In the Neebish Channels, alternatives include air bubbler systems on the channel bottom; preventive icebreaking; closing the West Neebish channel and dredging a two-way traffic land in the Middle Channel; and, opening both channels, one upbound, the other downbound. For the Pipe Island area, a series of small rock islands in the vicinity of the Pipe Island Turn immediately upstream of the Drummond Island ferry crossing was considered to stabilize ice cover in that area.

Shipping Lanes - Opening both the West and Middle Neebish Channels to winter navigation was considered to provide an up and down bound traffic lane around Neebish Island. One alternative that was considered was to dredge the 17 mile long Middle Neebish Channel to accommodate two lanes of traffic. Another alternative being considered is to develop a traffic control system that

would permit up and down bound traffic to use the existing navigation channel in the Middle Neebish Channel, i.e. use single lane for upbound 6 hours, then switch to downbound for 6 hours, etc.

Soo Locks Area - The formation and buildup of ice in the upstream and downstream lock entrances present major obstacles to winter navigation. Alternative solutions to control ice at these entrances include air bubbler systems to suppress ice cover in the channels and ice buildup on approach wall structures; an air bubbler-flusher curtain system across upstream lock entrances to prevent ice from entering the lock with vessels; propeller flow developers at the immediate lock entrances to suppress ice formation and increase the effectiveness of the air curtain; and a channel clearing or ice harvesting device to physically remove the ice from lock entrances.

The lock chambers themselves have ice buildup and present operational problems. Alternative solutions to suppress ice buildup and provide easy removal of ice are by coating the lock walls with epoxy; install bubbler-flusher systems around lock gates to flush ice out of lock recesses during gate operation; heat lock gates and hydraulic mechanisms to prevent ice buildup; provide a chain saw device to cut ice buildup from lock walls; install valves in the upstream lock gates to utilize the available head to push ice out of lock chambers; and provide an ice harvesting or chamber clearing device to remove ice from lock chambers. Other alterations considered at the Soo Locks were a safety boom gate housing, additional maintenance of lock facilities, cold

weather gear for lock operators, snow and ice removal of work areas, a water level warning system for the Soo Harbor - Little Rapids Cut area and sealing the floor of the Edison Sault Hydro-electric power plant.

Shoreline Impacts - Ship induced waves in the St. Marys River result in shoreline erosion and dock damage. Alternative shore erosion measures include rubble armor shore protection, Gabion basket and/or blanket, concrete or sheet pile walls, and relocation of channels. Alternative solutions for reducing dock damage include pile clusters, construction of removable or ice resistant docks, placing ice booms parallel to the navigation channel, or financial reimbursement for damage. Locations where erosion and dock protection measures may be installed include the Little Rapids Cut, 6 and 9 Mile Points, and the Middle Neebish Channel near Angle Courses 6 and 7 and 8 and 9 (Johnson Point).

Island Resident Transportation - Four islands in the St. Marys River are inhabitated by permanent residents. These are Sugar, Neebish, Lime and Drummond Islands. Alternative plans for each island to enable continuous transportation between the mainland and the island are as follows: Sugar Island - modification of the ferry, ice booms, ice stabilization structures, station U. S. Coast Guard tug at Ferry Crossing, preventive icebreaking, air bubbler-flusher system, relocation of the Soo sewage treatment outfall, ice stabilization by a network of nylon rope, diversion of Soo Edison wastewater and Canadian heated wastewater, flow diverters in Little Rapids Cut and an auto bridge to cross the Little Rapids Cut; Neebish Island - snowmobile or foot swing bridge across West Neebish Channel, ice boom at the head of West

Neebish Channel, ice stabilization islands, nylon rope network ice stabilization, channelization of West Neebish Channel, air bubbler system in West Neebish Channel, preventative icebreaking, and channelize the Middle Neebish Channel and not open the West Channel to winter traffic; Lime Island - Super airboat, air cushion vehicle, snowmobile route, aerial cable chair lift, wintering island residents on mainland, and station aircraft or icebreaking tug on island; and Drummond Island station icebreaking tug to assist ferry, modify ferry, install bubbler-flusher at docks, new icebreaking ferry, and ice booms/nylon rope/island stabilization structures around docking area.

Spills of Oil and Other Hazardous Substances - Spills of oil and other hazardous substances in the ice covered flowing waters of the St. Marys River could cause widespread damages to the aquatic ecosystem and may be impossible to clean up during the winter months. There is an existing contingency plan which covers all oil or hazardous substance spills. Alternative solutions address only prevention and not clean up of spills. These alternatives are to monitor hazardous material vessel movement, routine vessel inspection, double hull requirements, ice-strengthened hulls, collision avoidance systems, and limiting vessel movement of hazardous substances.

Disturbances of Bottom Substrate - As the high powered icebreakers and large commercial vessels force their way through the ice covered vessel track in the St. Marys River, ship induced pressure waves, propeller wash, and large ice blocks that are driven into the bottom of the channel by the vessels stir and resuspend bottom sediments. Alternative solutions developed to reduce turbidity were controlling vessel displacement (draft), speed reduction, and deepening the channel.

All-Weather Aids to Navigation - Alternative solutions to assist vessel movement through the river included ice buoys, the follow-the-wire method, laser aid to navigation, fixed navigation aids and Mini Loran C and Radar transponders.

Proposed Project Plan - The proposed plan is to provide for a fully operational twelve month navigation season through the St. Marys River. Alternative solutions (Figures 1, 2, 3, 4, 5, and 6) selected for the proposed plan include the following operational measures:

Icebreaking

Icebreaking will be required throughout the length of St. Marys River. Ice forms include sheet ice and drift ice. Icebreakers will be of two types: deep draft (Type B) and shallower draft (Type C). An icebreaking tug will be used in the harbor and at the locks. Two icebreakers, one of each type, would be stationed at Sault Ste. Marie.

Icebreaker Mooring Improvements

The additional icebreakers would need mooring facilities and pier space. Additional facilities are not needed at Sault Ste. Marie.

Vessel Traffic Control

Vessels in transit will be monitored through a series of pre-selected check points along the St. Marys River. Traffic control,

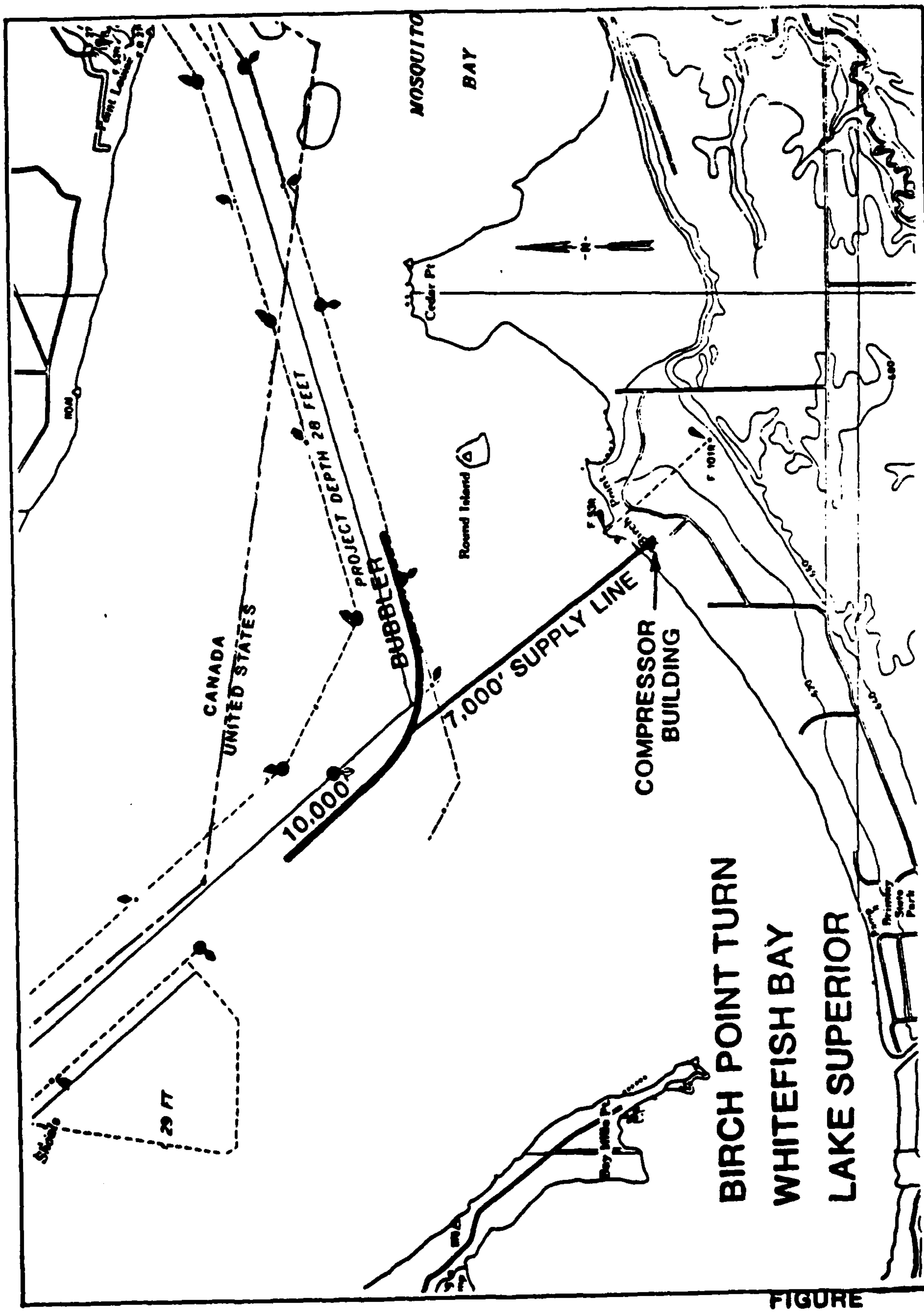
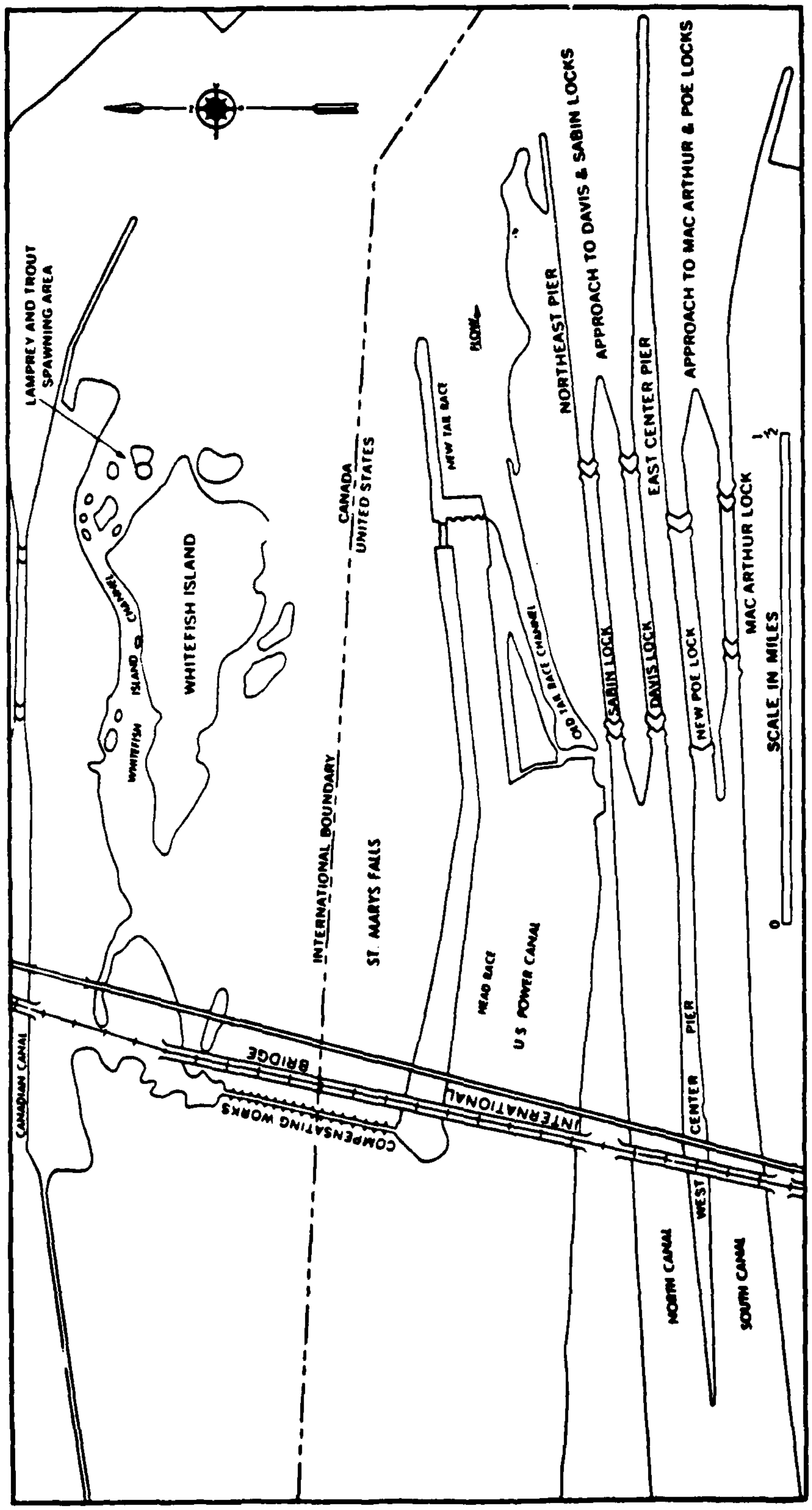

BIRCH POINT TURN
WHITEFISH BAY
LAKE SUPERIOR
CANADA
UNITED STATES
BUBBLER
PROJECT DEPTH 28 FEET
10,000'
7,000' SUPPLY LINE
COMPRESSOR BUILDING
MOSQUITO BAY
Cedar Pt
Round Island
29 FT

FIGURE 1



ST. MARYS RIVER
SOO LOCKS

FIGURE 2

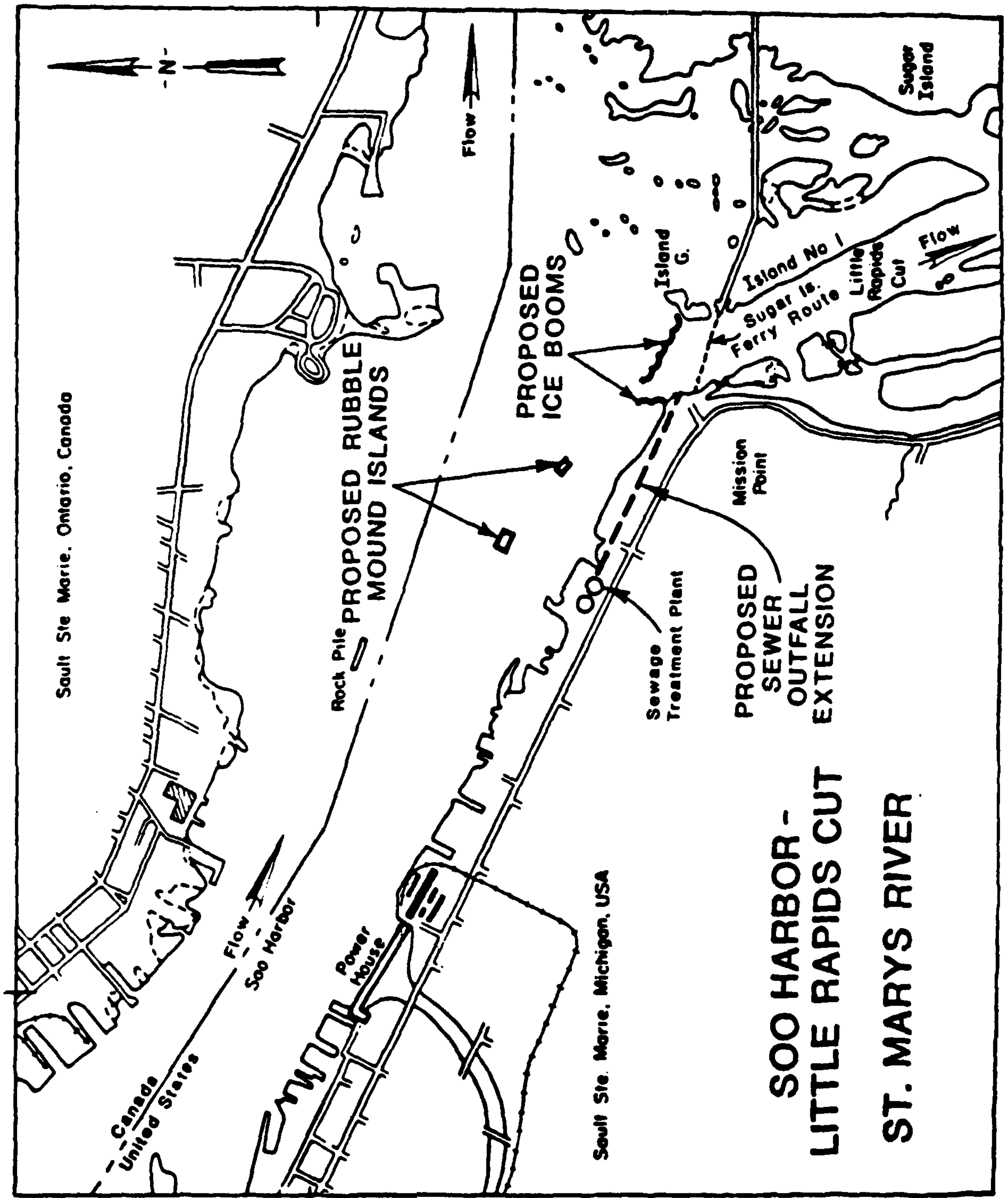

Sault Ste Marie, Ontario, Canada
N
Flow
PROPOSED RUBBLE MOUND ISLANDS
Rock Pile
PROPOSED ICE BOOMS
Island G.
Island No 1
Sugar Is. Ferry Route
Little Rapids Cut
Flow
Sugar Island
Mission Point
PROPOSED SEWER OUTFALL EXTENSION
Sewage Treatment Plant
Flow
Soo Harbor
Canada
United States
Power House
Sault Ste. Marie, Michigan, USA
SOO HARBOR - LITTLE RAPIDS CUT
ST. MARYS RIVER

FIGURE 3

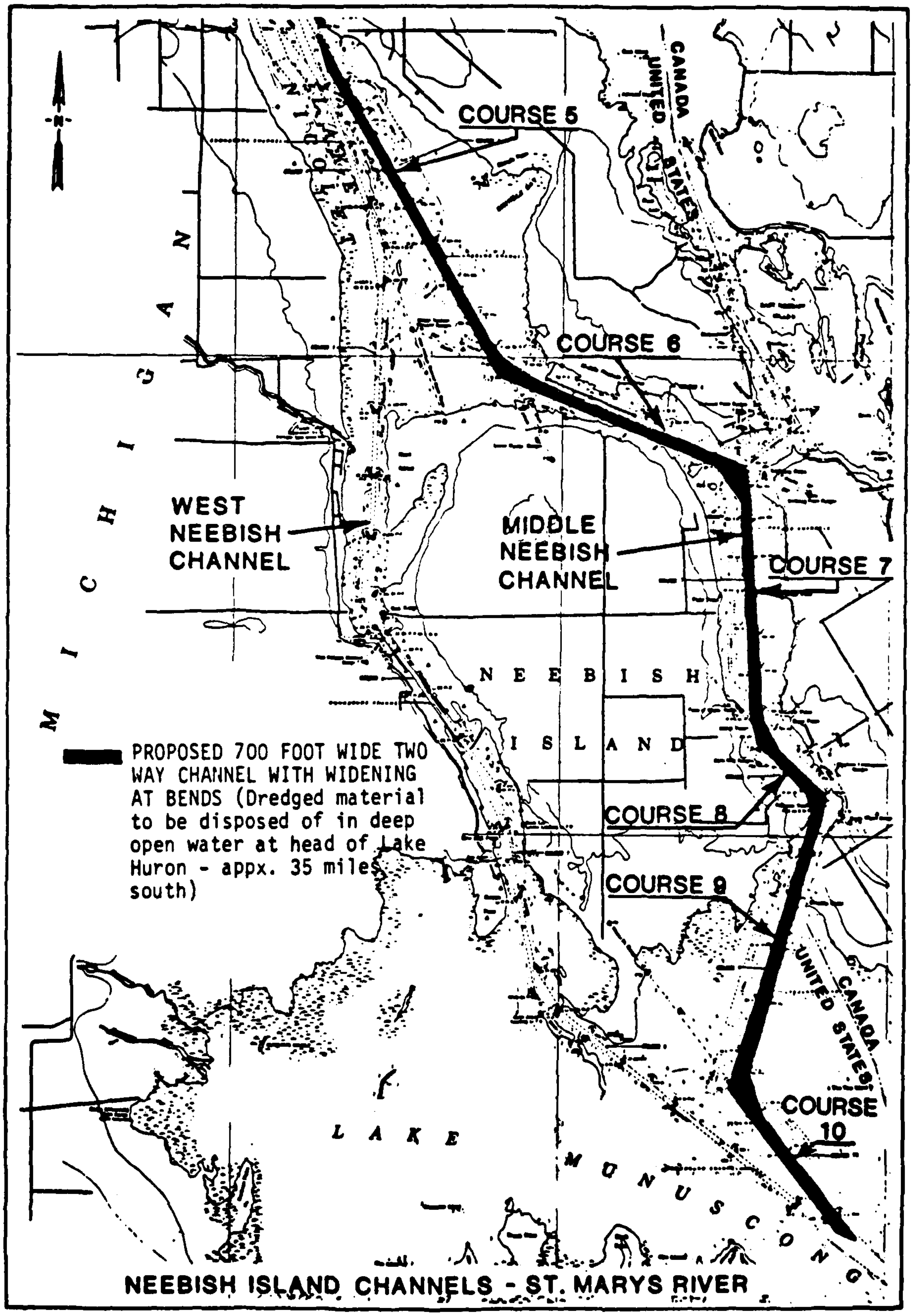

COURSE 5
CANADA
UNITED STATES
COURSE 6
WEST NEEBISH CHANNEL
MIDDLE NEEBISH CHANNEL
COURSE 7
MICHIGAN
NEEBISH ISLAND
PROPOSED 700 FOOT WIDE TWO WAY CHANNEL WITH WIDENING AT BENDS (Dredged material to be disposed of in deep open water at head of Lake Huron - appx. 35 miles south)
COURSE 8
COURSE 9
UNITED STATES
CANADA
COURSE 10
LAKE MUNUSCONG
NEEBISH ISLAND CHANNELS - ST. MARYS RIVER

FIGURE 4

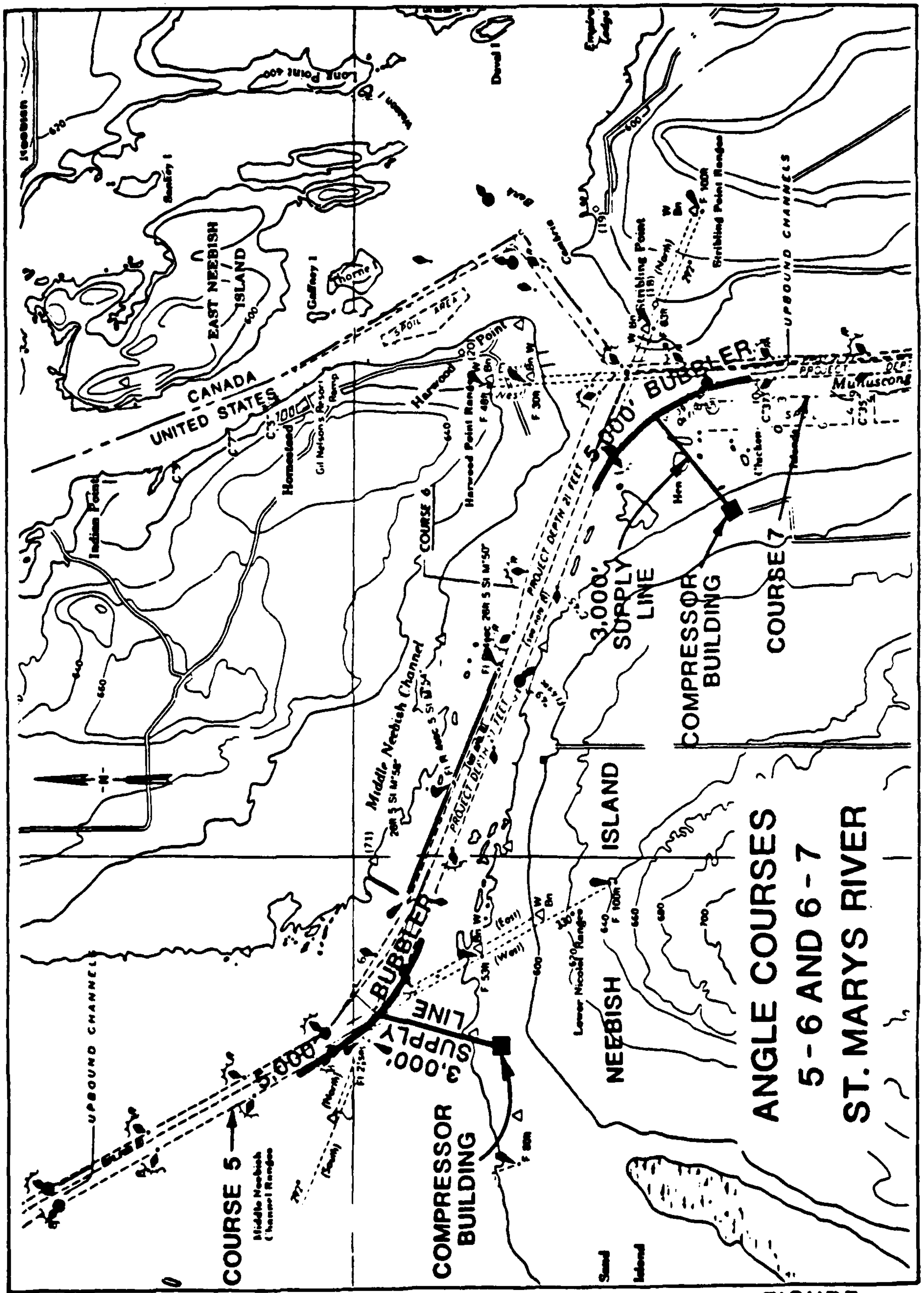

ANGLE COURSES
5-6 AND 6-7
ST. MARYS RIVER
CANADA
UNITED STATES
EAST NEEBISH ISLAND
NEEBISH
ISLAND
COURSE 5
COURSE 6
COURSE 7
COMPRESSOR BUILDING
COMPRESSOR BUILDING
3,000' SUPPLY LINE
3,000' SUPPLY LINE
5,000' BUBBLER
5,000' BUBBLER
UPBOUND CHANNEL
UPBOUND CHANNELS
Middle Neebish Channel
PROJECT DEPTH 21 FEET
Harwood Point
Indian Point
Homestead
Lower Nicolet Ranges
Middle Neebish Channel Ranges
Harwood Point Ranges
Stribling Point
Stribling Point Ranges
Sand Island

FIGURE 5

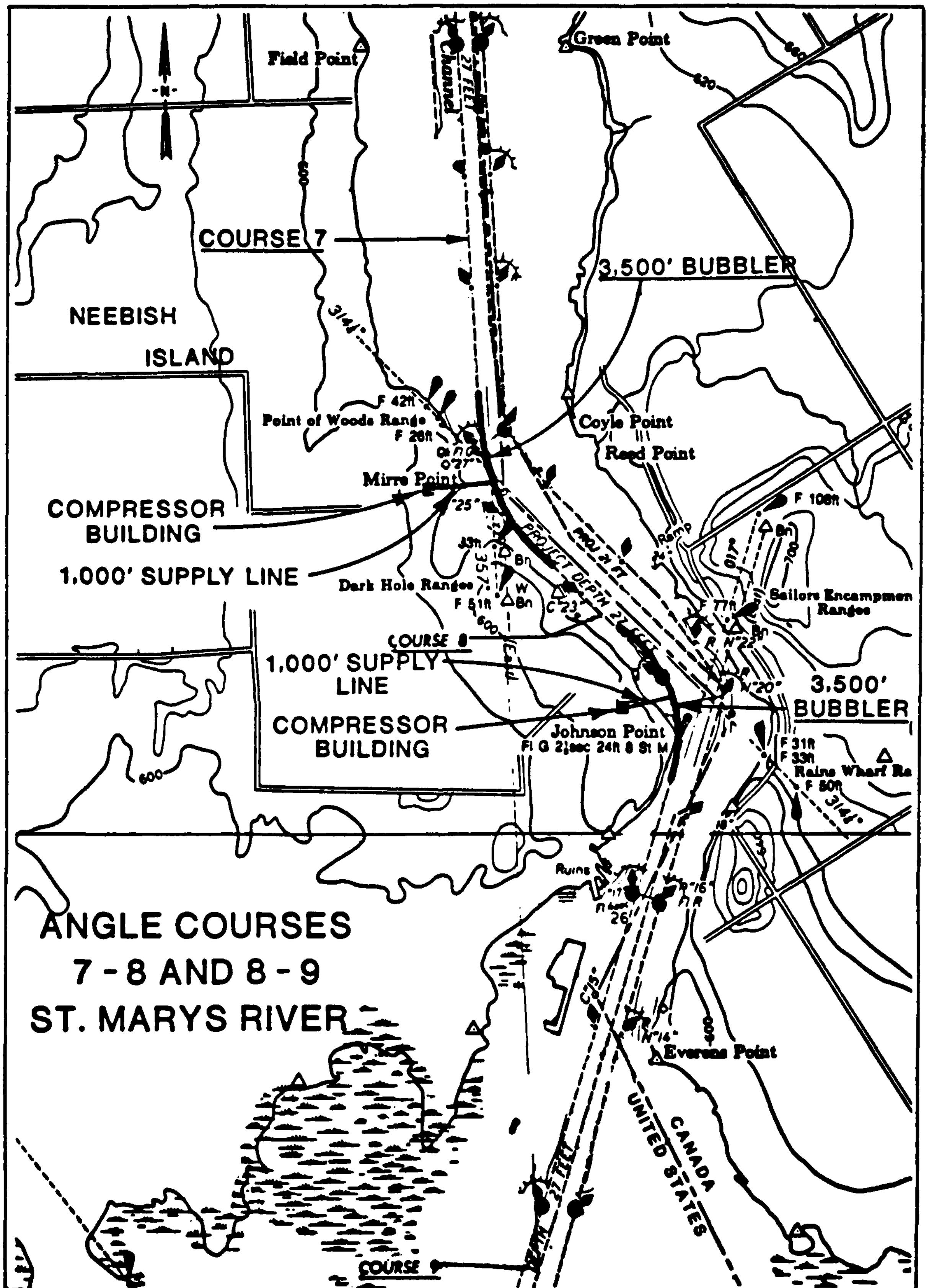

Field Point
Green Point
N
27 FEET Channel
COURSE 7
3,500' BUBBLER
NEEBISH
ISLAND
314°
Point of Woods Range
F 42ft
F 26ft
Coyle Point
Reed Point
Mirre Point
COMPRESSOR
BUILDING
1,000' SUPPLY LINE
PROJECT DEPTH 27 FEET
Dark Hole Ranges
F 51ft
F 106ft
Sailors Encampment
Ranges
COURSE 8
1,000' SUPPLY
LINE
3,500'
BUBBLER
COMPRESSOR
BUILDING
Johnson Point
F 31ft
F 33ft
Raine Wharf Ra
F 60ft
314°
600
Ruins
ANGLE COURSES
7-8 AND 8-9
ST. MARYS RIVER
Everens Point
UNITED STATES
CANADA
27 FEET
COURSE 9

FIGURE 6

as it exists on the river, is designed to prevent collisions and groundings. The vessels will check in with a traffic center at the locks.

Ice/Weather Data Collection/Dissemination Systems

An Ice Navigation Center at Cleveland was established for the Demonstration Program. This center receives and disseminates information on ice conditions, weather and related topics.

Aids to Navigation

These developments include the use of Mini-Loran C, navigation lights, beacons and radar reflectors. Eight fixed navigation lights will be constructed and located in the river. These facilities are rather small and will be located on land. The effect of these developments on the fish and wildlife resources will be insignificant.

Ice Control Structures

Immediately upstream of the Sugar Island Ferry Crossing, and in Soo Harbor, the ice cover is proposed to be stabilized by an ice boom system, a number of ice anchoring islands, and the relocation of the sewer outfall from the Soo sewage treatment to the head of the Little Rapids Cut. The ice boom system would be comprised of a 400 foot west boom extending from Mission Point and a 1,000 foot east boom extending from Island "G," a small island adjacent to Sugar Island. These booms would be a redesign of those used under the Demonstration Program. Two rubblemound

islands would be constructed on the south side of the navigation channel and upstream of the ice boom at Mission Point. The Soo sewer outfall would be relocated to a point immediately upstream of Little Rapids Cut.

Air Bubbler Systems

These developments consist of long perforated pipes, a supply pipe and air compressors. The air pressures used in the system would be between 10 and 15 psi, a relatively low pressure. They are not designed to keep an area ice free but to reduce the thickness of ice so that it can easily be broken. Bubbler orifices are spaced at approximately 20-foot intervals. Air bubbler systems are planned for Birch and Brush Point Angle Courses at the head of the St. Marys River, at Angle Course 5 and 6, 6 and 7, 8 and 9, and 9 and 10 of the Middle Neebish Channel and at the Lime Island Turn. Bubbler lengths would be 3,500 feet at Angle Courses 7-8 and 8-9, 5,000 feet at Angle Courses 5-6 and 6-7 and Lime Island Turn, and 10,000 feet at Birch Point Turn. There remains some question as to whether these bubblers will work in the flowing waters of these locations.

Lock Modifications

A bubbler air curtain across the upper lock approach in the upstream entrance for the Poe Lock is planned to reduce icing problems. Other works planned for this upstream entrance are a bubbler system along the approach channel or pier; an ice boom above the MacArthur Lock; the herding, by a small tug, of ice through the MacArthur Lock; and the heating of the pier walls

to keep ice from adhering to them. Icing problems in the downstream lock entrance of the Poe Lock would be handled by the placement of a bubbler along the pier; the installation of large gate valves to flush the area immediately below the lock gates; and the operation of a tug and sweeping boom to move ice into large areas not used by vessel traffic such as north of the east center pier. The existing air compressors that have supplied air for the air bubblers used during the Demonstration Program will be replaced by two larger units each having a capability of 2,000 cfm. Similarly, the additional requirements for steam to remove ice would necessitate the replacement of the existing boiler. Lock walls and gates would be coated with a co-polymer to reduce ice buildup. Ice that does adhere will be removed by portable steam hoses. Butterfly valves would be installed in upstream lock gates. These valves along with the use of a tug to herd ice from the dead water areas of the lock would be used to clear accumulated ice from the lock chamber. In addition, a bubbler flusher would be installed on the gates to remove ice from gate recesses. A high velocity pump system would be installed to flush ice from groin or heel areas of the upstream gates. Heating cables would be installed on gate recess machinery to prevent ice buildup. The rolling segments of the lock safety boom would be enclosed in a permanent house to keep them free of ice and snow. Other plans for the booms include installing panels on the boom tips and heating cables on the floor drains. Winter operation would also require various modifications made on Corps of Engineers tugs, derrick boats and gate lifters.

Power Plant Protection

The Edison Sault Power Plant in the Sea Harbor is susceptible to flooding from tailwater river stages at elevation 582.9 feet caused by ice jams downstream. The plan for floodproofing the power plant consists of waterproofing the floors and walls, providing watertight stop logs at the doors and installing backwater valves in floor drains. The ice booms at Little Rapids Cut are designed to minimize ice jams and were discussed previously. The floodproofing will not affect fish and wildlife resources.

Dredging

Dredging the Middle Neebish Channel to permit two way vessel traffic is proposed. The present 27.5 foot navigation channel through this narrow 17 mile long reach of the St. Marys River has a bottom width of 300 feet. The proposal is to widen this channel to a bottom width of 650 feet removing 12 million cubic yards of river bottom consisting of limestone rock, gravel and soft materials. The dredged spoil would be dumped at the head of Lake Huron into 100 to 150 feet of water.

Shoreline Protection

We have been informed by Detroit District Corps of Engineers personnel that approximately 118,650 linear feet (22.5 miles) of shoreline on the St. Marys River have been identified as erosion prone. Alternative means of protection are still being evaluated. With regard to shore structure protection, studies are underway to identify structure damage prone areas. No selection of structural solutions are indicated in the survey study.

Island Transportation Assistance

Construction solutions to prevent ice flows from clogging the Little Rapids Cut and interrupting the Sugar Island Ferry passage are the same as those described under Ice Jams and Flooding. In addition, a bubbler-flusher will be installed at the mainland ferry dock to keep the ferry landing clear of ice. For Lime Island residents the construction, operation and maintenance of an ice boat is proposed. At Drummond Island a short ice boom to protect the ferry dock from moving ice is proposed. A low pressure bubbler on the ferry track will be installed to maintain a weakened zone for the ferry to pass through.

Connecting Channel Operational Plans

In the St. Marys River, the plan of operation was developed and successfully implemented during the Demonstration Program.

Water Level Monitoring

This monitoring will be done in the connecting channels. Some small buildings will be constructed to house additional water level recording gages. There would be insignificant effects on fish and wildlife resources.

Vessel Speed Control and Enforcement

The plan proposes that the U. S. Coast Guard is responsible for the control and enforcement of vessels and their speed. The Coast Guard sees no need to change present speed limits because shoreline damages and erosion are the responsibility of the vessel operator. Cause of damage is determined by the Coast Guard.

Safety/Survival Requirements

These developments will not affect fish and wildlife resources.

Vessel Operating and Design Criteria

These criteria have been developed to promote safe vessel operation in all United States waters. For vessels operating in ice, the criteria are explicit about hull strength, power plant size, strengthened steering mechanisms, special propellers and other special gear. There also are special criteria for oil and hazardous substance transporters. Enforcement of these criteria will reduce the probability of accident and serious spills. Vessels do and will continue to operate that are not in compliance with these criteria. No additional regulations or enforcement are proposed in the plan.

Search and Rescue Requirements

These requirements will not affect fish and wildlife resources.

Oil/Hazardous Substance Contingency Plans

The Coast Guard is the designated responsible agency for these plans on the Great Lakes. They feel that present plans are adequate. These plans include one stockpile of materials used to contain spills. A Regional Response Team also exists and the Service is a member. The National Strike Force, a highly trained Coast Guard unit, has a four-hour response time to reach the nearest suitable airport. The arrival of all required cleanup equipment could be much later. The actual cleanup of a spill is contracted to private companies. No plan thusfar devised has the capability of providing immediate containment and cleanup of spills in the flowing, ice covered, and meandering connecting channels. The Fish and Wildlife Service believes that

present oil/hazardous material spill response capability does not assure the protection of fish and wildlife.

Vessel Waste Discharge (non-Human) Requirements

These requirements and standards have been set and enforced by EPA. These requirements include the equivalent of secondary treatment. No wastes are to be discharged into the waters of the lakes. The problem of disposing of these wastes in special harbor facilities is being studied.

Environmental Plan of Action

The Fish and Wildlife Service and the Corps of Engineers have determined that much information is needed to make a precise evaluation of the project effects. The EPOA is an attempt to acquire and evaluate the needed information and predict the effects of the project. The plan also will provide for monitoring project developments to verify predictions, and will culminate in a report recommending ways to eliminate or minimize adverse effects.

C. Fish

1. Without the Project

The St. Marys River meanders southward to discharge its cold waters into the northern portion of Lake Huron. The bays and lakes that occur in the expanded portions of its course have extensive wetland areas. The constrictions, expansions and meanders cause variations in current patterns and add diversity to the bottom substrate and aquatic medium. This diversity in habitat supports many species of fish.

The St. Marys River system contains cold and warm water fish species. The diversity of river and shallow lake habitat types within the system and the presence of Lake Superior and Huron at either end insure the propagation of both fish communities. Although a comprehensive list of over 42 species has been developed, and data on life histories, water quality, and floral and benthic communities are available, adequate baseline information on the biological interactions that support this fishery is lacking.

The St. Marys Rapids is a unique area that is known for its excellent fishery. As early as 1830, visitors congregated to watch Indians in bark canoes netting and spearing lake whitefish (Coregonus clupeaformis). In 1883, Ontario introduced rainbow trout (Salmo gairdneri) into Lake Superior. Sustained by frequent stocking by Michigan and Ontario, together with natural reproduction in the Rapids area, this species has become an important component of the Rapids fishery (Feasibility Study of Remedial Works in the St. Marys Rapids at Sault Ste. Marie, September, 1974, p. 2-18). Walleye (Stizostedion vitreum) has been another important species in the Rapids area from early settlement times.

Over the years, the historic whitefish and walleye fishery in the Rapids has declined. Although the same is true for the introduced rainbow trout fishery, it still provides quality fishing. The Rapids cascade from their crest to the approximate level of Lake Huron in about one half (½) of a mile. The fall over this distance is more than 20 feet. The width of the unrestricted Rapids is approximately

one quarter (¼) of a mile. The substrate is composed mostly of boulders, rock, gravel, sand and exposed bedrock. This provides a highly productive substrate for the development of a variety of benthic organisms and shelter for forage fish. In addition to this supply of forage, spawning habitat is provided for rainbow trout and other species. The combination of physical features and high biological value categorizes the celebrated St. Marys Rapids, an area unique to the drainage system of the Great Lakes.

In considering the entire St. Marys River System, yellow perch and white sucker are the most common sport fish found in the river. Northern pike, walleye, rock bass, bullheads and rainbow smelt are also important sport species. Areas in which these species are most likely to be taken are the lake and bay areas. Seasonal migrations of cold water species such as the lake whitefish, lake herring, rainbow smelt, lake trout and rainbow trout occur for spawning or temperature regulation into and out of the river. Very little information is available on spawning and nursery areas in the river system. However, the wetlands, rocky shoals, and clean, coarse gravel areas in running water have been observed to be used for spawning by most of the above mentioned species. Former suspected or known spawning areas include the Iroquois Island Shoals for lake trout and lake herring; the St. Marys Rapids area for rainbow trout, lake whitefish, lake sturgeon, and walleye; Lake Munuscong at Birch Point, Roach Point, Barbeau Point, Munuscong Island, between Barbeau and Maple Point and the Munuscong River for walleye and possibly smallmouth bass; and areas

of rooted aquatic vegetation, river and lake bottom substrate and debris scattered throughout the river system for northern pike, yellow perch and many other species. No comprehensive survey of spawning and nursery areas, species composition, population dynamics and movement patterns have been conducted in the river. Some species such as the longnose gar and the lake sturgeon have virtually disappeared or are very rare. Others such as the lake whitefish and lake herring have drastically declined in number.

Because there is so little known about the St. Marys River fishery the Michigan Department of Natural Resources (MDNR) conducted a sampling program in August, 1975. Some information on the distribution of fishes in the river system was achieved for this time of the year. Sampling techniques restricted the collection to larger species. The river above the St. Marys Rapids was dominated by yellow perch, followed by white sucker, lake whitefish and northern pike. Five other species including brown trout and coho salmon were also collected. In Lake Nicolet, white suckers were most common followed by yellow perch, northern pike, brown bullhead, lake herring and walleye. Four other species were also collected including lake whitefish and brook trout. In the Raber Bay area the dominant species by far was the lake herring. This species was followed in abundance by the rainbow smelt, white sucker, yellow perch and northern pike. Walleye, splake, lake whitefish and five other species were also collected. The species most common in the Munuscong Bay area was the rock bass followed by the redhorse, yellow perch, northern pike and brown bullhead.

Other species included the walleye, smallmouth bass and lake sturgeon. The fishery in Potagannissing Bay was dominated by yellow perch and white sucker. Lake herring, black bullhead, rainbow smelt, rock bass, northern pike, walleye, rainbow trout, splake, lake whitefish, smallmouth bass and five other species were also collected from this bay.

In addition to the well-known rainbow trout and walleye sport fishery at the St. Marys Rapids area, the other areas discussed above provide a significant sport fishery during the spring, summer and fall. The winter months are also productive for ice fishing in the St. Marys River area. The Bureau of Outdoor Recreation (presently Heritage Conservation and Recreation Service) conducted a study of winter recreational activity on the river in 1974-75. In their report, "Navigation and Winter Recreation," they describe ice fishing activity from above Sault Ste. Marie down to DeTour which includes virtually the entire length of the river. The MDNR has also conducted year-round surveys of fishing activity in the area. Beginning at the upper river, the area between Mosquito Bay to Leigh Bay is a good ice fishing area for whitefish. It is usually best in the early winter, however, fishing does extend into March. This same area is also noted for continuous catches of yellow perch, northern pike, lake herring and yellow perch throughout the winter. There is little ice fishing done in the Rapids or the Soo Harbor area primarily due to inaccessibility and danger from fast-moving flow ice. Two areas in Lake Nicolet produce good ice fishing success. These are Shingle Bay and the area surrounding Nine Mile Point. Yellow perch and northern pike are the most common species taken from

these two areas. In the West Neebish Channel below the rock cut, ice fishermen take lake herring early in the winter and walleye, northern pike, and burbot throughout the winter months. Lake Munuscong historically has consistently been a good producer of walleye throughout most of the winter season. Other species taken from this lake include northern pike and yellow perch. The area near Lime Island has been an excellent ice fishing area for lake herring. This has tapered off in the last several years for unknown reasons. The area below Lime Island and above DeTour is a good producer of northern pike and yellow perch for ice fishing enthusiasts.

The water in the St. Marys River, with the exception of that area on the Canadian side from the Soo downstream to Little Lake George on the north Sugar Island Channel, is considered to be of a good quality. We assume that the degraded waters on the Canadian side will improve in the future. With the enforcement of existing policies and regulations protecting wetlands and governing the development on other important shoreline areas, there should not be significant losses of this habitat type. Threats to the fishery resources of the St. Marys River would be from urban and industrial development and commercial vessel traffic, including the use of larger displacement vessels. This latter category is felt to pose the most serious and immediate threat to the St. Marys River fishery resource.

As a result of the Demonstration Program, adverse effects of winter navigation have been observed on the fishery as well as on its recreational use. Effects on the fishery include disturbances to bottom substrate and aquatic habitat resulting from vessel passage and icebreaking. These disturbances can be expected to adversely affect benthic communities and the distribution and abundance of some fish species.

Recreational ice fishing is being affected by vessel passage. Local citizens in the area have indicated that the pressure waves and resultant ice cracking and breaking caused by some passing ships are creating conditions too dangerous for ice fishing. How serious and widespread these effects are is not known at this time.

The following is a listing of various segments of the project with anticipated effects on the fishes of St. Marys River.

Icebreaking

Icebreaking will take place along the entire river and in Soo Harbor by both icebreaking and commercial vessels. The effects are concentrated in near-shore areas, shallow bays and harbors. Propeller wash could cause currents which resuspend sediments and cause bottom scour displacing benthic communities. Fish would be exposed to turbulent currents causing additional stress. Loss of fishery resources could result from both effects.

The noise resulting from breaking and widespread cracking of ice and from ships scraping ice as they plow through the vessel track is a disturbance that may have adverse effects on the fishery. These noises may affect the distribution and movement of fish which, in addition to inflicting stress, may also make it difficult to harvest them by ice fishing. Sound has been used to scare fish and herd them into nets. It also has been used to attract fish. There is not enough known about the effect of icebreaking noise on fish to make a determination.

Commercial vessels and icebreakers cause a buildup of ice along the edges of the vessel track. This buildup forms a wall of ice in places that may extend 15 to 20 feet deep. During spring breakup these buildups of ice form small icebergs that could drift downstream with the current. When this ice comes in contact with the bottom substrate, it causes erosion. If these ice formations are numerous at spring breakup along the 75 mile long river, a substantial amount of bottom erosion could be expected with associated loss of benthic communities and fish spawning and nursery areas.

Icebreaker Mooring Improvements

Additional icebreakers would need mooring facilities and pier space. An access channel may be needed between the navigation channel and the proposed pier. The project-plan does not give enough detail to determine what resources may be affected. We assume that these mooring facilities will be located at or near existing Coast Guard facilities at Sault Ste. Marie.

Ice Control Structures

Ice booms are proposed in the lower portion of Soo Harbor. These booms have been in place during the demonstration phase but will be redesigned for authorization. Ice booms do not appear to have significant effects on the fish resources. The redesigned anchors will be buried in the bottom and left in place. This could cause minor losses of habitat.

The ice stabilizing islands would have some effect on the fishery of Soo Harbor. The bottom habitat would be displaced by the rock and rubble island; this would be beneficial for some species and detrimental to others.

The changing of the sewage outfall could have a profound effect on the fishery. The effects will depend on the quality of the effluent. The area downstream in the Little Rapids Cut and beyond would be degraded. The benthic community composition could be degraded as a fish food supply. More information is needed to make an evaluation of the effects.

Air Bubbler Systems

The air bubblers, if operated as described in the proposed plan, should not have significant effects on the fishes of the St. Marys River. Operating air pressures would not produce an air curtain effect because the jets are too far apart and the bubbles would not spread far enough to meet. Currents generated would probably not be strong enough to

resuspend bottom sediments. The operating plan does not state whether the bubblers would be operated continuously or intermittently. There might be a local increase in dissolved oxygen levels.

Dredging

Fishery resources of the St. Marys River would be adversely affected by the proposed 17 miles of dredging of the Middle Neebish Channel for two way winter traffic. The spoil material, to be placed in Lake Huron in 100 - 150 feet of water, also would have adverse effects. Fish and benthic habitat would be destroyed by widening the channel. This permanent loss of habitat would reduce fish and benthic populations.

Shoreline Protection

Riprapping shorelines subject to erosion in the St. Marys River can have beneficial as well as adverse effects. This depends on the area to be riprapped and the type of fishery habitat affected. Stopping erosion is beneficial while changing fish and benthic habitat can be harmful. The shorelines that are proposed for riprapping have not been delineated. The effects of this proposal cannot be evaluated at this time.

Island Transportation Assistance

The described developments for the Sugar, Neebish, Lime, and Drummond Islands, are thought to have insignificant effect on the fisheries of the St. Marys River. Some sedimentation might occur near the Sugar ferry slips but would be very localized.

Vessel Speed Control and Enforcement

This part of the plan could have a profound effect on fishery resources in the basin including several locations within the St. Marys River. Vessel speed is one factor that contributes to the production of damaging pressure waves in shallow confined channels. Many of the narrow and shallow parts of the river, including the area downstream from Little Rapids Cut to and through Raber Bay, fit this general description. Excessive vessel speed (even within the legal limit) has caused severe environmental damages in these areas. Fishery resources have been directly eliminated and their habitat and food supply reduced. Without adequate vessel speed limits and enforcement at the above-mentioned critical areas, fishery resources could be severely affected or eliminated.

Commercial vessel movement through the ice covered waters of the St. Marys River may cause large areas of the river bottom to be in a perpetual state of instability. In the navigation channel this is the result of constant propeller

wash and ice movement. Outside of the navigation channel the instability of the bottom substrate and the elimination of benthos and fish habitat will be caused by ship induced pressure waves producing very fast, erratic water currents. These currents sweep everything before them. The effects of vessel passage is intensified during the winter months compared to that of summer because the ice acts as a container lid restricting the vertical movement of water. Sedimentation and bottom erosion from this phenomenon has been observed. The pressure wave phenomenon takes place under certain circumstances and in defined areas. Other factors being equal, there is a strong positive relationship between the ratio of vessel cross-sectional area to channel cross-sectional area and the magnitude of the pressure wave. At slower vessel speeds, the water pressure wave is not as strong. A threshold speed must be surpassed for the wave to be damaging. This critical speed can be calculated for given segments of the river if the cross-sectional areas of the ship and channel are known. This phenomenon has been studied by the Corps of Engineers' Cold Regions Research and Engineering Laboratory (CRREL) personnel but needs further study. The critical areas where this occurs also need to be fully identified.

The frequency of ship-induced wave disturbances to the aquatic medium that will result if future traffic projections are accurate can be expected to create severe physical stresses on fish and their habitats in the narrower reaches of the St. Marys River system. Fish cannot overcome the

current velocities developed by strong pressure waves in near-shore areas. They would be tumbled about and subject to high rates of physical damage. Mortality could be very high. Benthic organisms also could be subjected to very high mortality. Pressure waves not strong enough to cause fish mortality could still cause significant stress. In littoral and wetland areas, pressure waves of virtually any magnitude cause the ice cover to lower and raise about its mean elevation. Aquatic vegetation anchored to the ice will likely be uprooted, causing a loss of spawning habitat for early spring spawners such as northern pike and muskellunge.

Recreational ice fishing in the St. Marys River can be expected to decline further as the number of ships using the system increases. Unsafe ice conditions resulting from the existing winter navigation appears to be severely limiting the areas that are suitable for ice fishing. Most of the adverse effects result from ship-induced pressure waves.

<u>Vessel Operating and Design Criteria</u>

Presently there are ships operating in the Great Lakes which do not have the modifications outlined in the Coast Guard's operating and design criteria. Fishery resources and human lives are imperiled because ships have not been modified to include the needed safety features. Failure to require compliance with vessel operating and design criteria for winter shipping could result in a major disaster.

Oil/Hazardous Substance Contingency Plans

Spills of oil, other petroleum products and toxic substances have the potential to produce catastrophic impacts on fish and wildlife resources in the entire Great Lakes - St. Lawrence Seaway System. Such impacts might include, but are not limited to, oiling and subsequent death of waterfowl, shorebirds and raptors; smothering and/or chemical poisoning of all types and life stages of aquatic life and terrestrial scavengers; and the destruction or degradation of reproductive habitat for fish, waterfowl and shorebirds.

The U.S. Coast Guard believes its Oil/Hazardous Substance Contingency Plans provide for optimum response and cleanup in the event of a spill of oil or other toxic substance anywhere in the Great Lakes System. The Service believes that regarding the protection of fish and wildlife resources, these plans have a number of weaknesses, particularly with respect to recovery team and containment/cleanup equipment response times and with the inefficiency of the equipment and techniques presently being used to perform cleanup operations.

Presently, the National Strike Force personnel have a 4-hour response time to arrive at the airport nearest the spill where C-130 cargo aircraft could land. From there, they would proceed to the spill site. Regional teams could be on site in somewhat less time, and local teams could be on site in about the same time as Regional teams. These teams would then have to assess the situation and call for the proper equipment which may take a minimum of 3 or 4 more hours to become operational. Some equipment needed for recovery, such as collection barges, might take as long as a week to be on site.

Under these circumstances, a spill occurring in the St. Marys River could, assuming a flow of 2 feet per second, spread five miles downriver before the National and Regional Recovery Teams are onsite and travel an additional 5 miles before serious containment efforts are underway. To a lesser extent, the same problem would exist in the open waters of the Great Lakes under windy conditions. To date, containment booms have not performed satisfactorily under the best of conditions. Estimates for the overall efficiency of oil containment and recovery equipment run as low as fifty percent. Though the existing Contingency Plan has not been tested in winter, we suspect that the efficiency of both men and equipment would be reduced even further by the cold, hindering implementation of the recovery effort.

Environmental Plan of Action

The type of biological information necessary for the Service to make detailed and accurate evaluations of project effects on the fishery resources of the St. Marys River is not presently available. Accurate fish stock assessments, spawning area surveys and other baseline information are proposed in the EPOA. The plan also proposes monitoring studies of the biological and physical impacts of project features on fishery resources. The plan also proposes investigations into presently available, as well as new, methodology which can be used to minimize or eliminate adverse effects of the project.

D. Wildlife

1. Without the Project

The St. Marys River drainage basin is composed of a wide diversity of habitat types which support a wide spectrum of the wildlife species known to inhabit the Great Lakes Region.

The habitat types found in this drainage include hardwood and coniferous forests, pastures, croplands, inland marshes and abundant permanent and temporary wetlands contiguous to the St. Marys River.

Over 60 species of mammals may be found in the basin, some of which are very important to man as game animals. These include whitetail deer, black bear, snowshoe hare, bobcat, gray squirrel, raccoon, red fox, coyote, skunk, beaver, river otter, weasel, mink and muskrat. Of the numerous bird species that can be found in the St. Marys River basin, woodcock, ruffed grouse and numerous species of ducks and geese are harvestable resources. Over 25 species of reptiles and 20 species of amphibians occur in the area. In addition to their value as a harvestable resource, wildlife of the basin provide important recreational opportunities for non-consumptive users. Although the mammals, reptiles and amphibians are certainly important components of this fauna, the birds are probably seen and enjoyed by more people than the other three classes combined. Water-related birds would be most affected by the project.

The shoreline, islands, wetlands and shallow waters provide feeding, resting and nesting habitat for many waterfowl, shore and wading birds, colonial nesters, and songbirds. Waterfowl commonly seen in the basin include whistling swan, Canada goose, snow and blue geese, mallard, pintail, black duck, gadwall, American wigeon, northern shoveler, blue-winged and green-winged teals, wood duck, redhead, canvas-back, ring-necked duck, lesser and greater scaup, common goldeneye, bufflehead oldsquaw, ruddy duck, and common, red-breasted and hooded mergansers. Common loons migrate and summer along the river. Herring gull, ring-billed gull, common tern, Caspian tern, black tern, black-crowned night heron, snowy egret, and great blue heron all are found along the river.

Important migration areas have been listed for birds of prey, shore birds and migrating passerines along the river. Many waterfowl including scaup, common goldeneye, bufflehead and common and red-breasted merganser winter in open water areas of the harbor and around the power plants.

The frozen river permits mammals such as deer, timber wolf, coyote, fox, bear, bobcat and martin to range back and forth between Canada and Michigan's upper peninsula or between the islands and the mainlands. The movement of these mammals may be in search of food when local supplies become diminished during the deep snow months.

Federally endangered species which may visit or pass through the St. Marys River area include the American and Arctic peregrine falcons. The bald eagle has Federally threatened status in Michigan. Bald eagles have been observed around the harbor areas and along the river during winter.

2. With the Project

Various operational measures considered necessary for extended season operation on the St. Marys River could produce changes in the environment which would affect wildlife of the river year-round.

The following is a listing of the various segments of the project with anticipated effects on the wildlife of the St. Marys River:

<u>Icebreaking</u>

Icebreaking will take place throughout the length of the river system. The effects are concentrated in near-shore waters where the vessel track is within a dredged channel. Propeller wash causes currents which resuspend sediments and cause bottom scour displacing benthic communities used as food by wintering waterfowl and shorebirds. Icebreaking may create and maintain open water areas attractive to waterfowl. In addition, maintenance of an unstable ice cover on the St. Marys River may preclude the normal cross-channel movement of large ungulates (moose and deer) and inhibit such movement by other mammals.

Icebreaker Mooring Improvements

Additional icebreakers would need mooring facilities and pier space. An access channel may be needed between the pier and the navigation channel. The project plan does not give enough detail to determine what resources may be affected. Icebreakers will be moored at or near Coast Guard stations and no new facilities are needed.

Ice Control Structures

Ice booms are proposed at the head of Little Rapids Cut. A small amount of open water may remain behind the booms. This may be attractive to waterfowl but will be over relatively deep water and, therefore, be used only for resting. The anchors will be buried in the bottom and left in place. This could cause minor losses of bottom habitat and benthos.

Air Bubbler Systems

The air bubblers located at the turns, if operated as described in the proposed plan, should not have significant effect on wildlife resources. This would be true if bubblers do not create areas of open water. Bubblers, operated at low air pressures, would probably not resuspend bottom sediments. The operating plan does not state whether the bubblers would operate all the time or intermittently.

Dredging

Dredging in the Middle Neebish Channel would produce 12 million cubic yards of spoil material. Disposal would be in Lake Huron. The dredging of the channel could affect wildlife resources. Channel widening will displace benthic habitat thus reducing benthos used by some species of water birds for food. This benthos loss would be permanent and would also affect the food supply of migratory and resident birds. Spoil placement in the deep waters of Lake Huron would not adversely affect wildlife.

Vessel Speed Control and Enforcement

This development can have a profound effect on the wildlife habitat within the areas of pressure wave generation. The shoreline, wetlands and shallow water areas are particularly vulnerable to this phenomenon. Vessel speed is one of the factors governing the generation of these pressure waves. The areas where these waves can be generated include virtually all of the river from Little Rapids Cut to Raber Bay. Excessive vessel speed has caused severe damages in parts of the system already. Wildlife habitat has been severely damaged or eliminated. Without adequate vessel speed limits and enforcement at the above-mentioned critical areas, wildlife habitat could be eliminated.

Vessel Operating and Design Criteria

As described in the fish section, there are ships presently operating in the Great Lakes which do not have the modifi-

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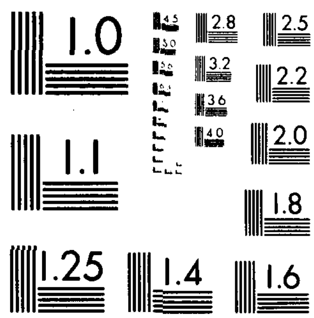

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cations outlined in the Coast Guard's operating and design criteria. Wildlife resources, especially waterfowl, are particularly vulnerable and imperiled because these ships are not modified and are subject to a higher probability of accident. Strict requirements incorporating these modifications for winter navigation would reduce the chances of a major disaster.

Oil/Hazardous Substance Contingency Plans

Existing contingency plans are untried in winter. Several of the described plan segments do not adequately protect wildlife resources, particularly the vulnerable waterfowl. The response times needed for the National Strike Team and the Regional Teams are too long. By the time the equipment is on site, the spill could extend a long distance, especially when carried by strong currents or driven by winds. Heavier petroleum products will sink to the bottom smothering benthic food organisms. Vegetation coming out in spring also could be affected by a winter spill. In addition to the long response times, some cleanup equipment is less than satisfactory. More effective equipment should be obtained and conveniently stockpiled throughout the basin.

Environmental Plan of Action

As was described in the fish section, the plan of action is designed to acquire information that will allow a detailed and accurate evaluation of project impacts.

E. Discussion

Possible impacts of extending the navigation season have been mentioned in a qualitative manner in previous sections. Much information is not presently available to make quantitative predictions about the project effects on fish and wildlife populations and habitats.

Vessel-caused pressure waves through constricted areas of the St. Marys River have been observed to cause heavy movement of bottom materials. Although lake trout are not currently reproducing, there is hope that rocky shoals that were used in the past will again support self-sustaining populations. Major lake whitefish spawning grounds have been identified at the rapids. Other whitefish and lake herring spawning areas in the river are likely to be found. Since the lake trout, lake herring and lake whitefish are fall spawners, winter disturbance of sediments would affect the vulnerable egg and early larval stages. Vessel traffic could also affect ice fishing which occurs near some of the islands and the mainland.

Icebreaking and navigation through the ice covered waters of the St. Marys River will result in a vessel track that could disrupt cross channel movement of mammal species between Canada and the upper peninsula of Michigan and between the islands and the upper peninsula. Some species that may be affected by the vessel track are whitetail deer, timber wolf, coyote, fox and bobcat.

The pressure wave which breaks the ice cover also forces water through these breaks. Along with the water comes bottom sediments, aquatic vegetation and fish. The fish which have been sprayed onto the ice attract bald eagles, foxes and other scavengers. The long-term effects of this phenomenon on wildlife is not known at this time.

Effects of dredging the Middle Neebish Channel could include the reduction in production of benthic organisms, mortality to fish eggs and larvae and destruction of aquatic habitat from dredged material disposal.

The Great Lakes' few sheltered open water areas with an adequate food supply are important to wintering waterfowl. Waterfowl from a widespread breeding area are concentrated in and near them during winter. Waterfowl attracted to these areas feed on small fish and benthos. If this food supply is depleted, they may be unable to find another protected area with adequate food. The nutritional state of migrating waterfowl in fall and early winter appears to be very important. Reproductive success depends on adequate nutrition in the pre-reproductive period of spring migration. If fish and benthos are reduced by winter shipping, waterfowl reproductive success might be affected.

The impact of reduced benthos is not limited to fishes. Waterfowl, particularly the diving ducks such as scaups, canvasback, goldeneye and bufflehead, actively feed on benthos.

The probability for elimination of benthos, fish and bird life from large parts of the river--or well beyond--seems greater from discharges and spills during winter in this rocky river. The impact would depend on the timing, substance, weather, clean-up effectiveness and other factors. The loss of a year-class of fish such as whitefish or perch could seriously affect the ability of other fish as well as gulls, terns, cormorants and herons to survive. The reduction in man's recreational and commercial catch is incidental in comparison.

Spills and discharges are known to be harmful to fish and wildlife. Both internal (ingestion of contaminated food) and external factors result in increased mortality. For example, birds in the water at the site of petroleum spills lose both insulation and buoyancy and, unless only very lightly oiled, almost always die from hypothermia, drowning or poisoning. Even with the best available human intervention a very low percentage of oiled birds survive.

Winter complicates cleanup efforts and a spill in the river would be expected to contaminate the shoreline and large areas of deep water. The extent of the area contaminated and the amount of oiling that would occur cannot be predicted because of numerous variables involved.

A preliminary list of effects of winter navigation that need to be addressed by further study are:

(1) The areas of the river bottom that are disturbed by ship-induced waves, propeller-generated ice, propeller wash, and large ice chunks, gouging the bottom at spring breakup, need delineation. The subsequent impacts on the distribution, community size, structure and biomass of plankton, benthos, and macrophytes, and on spawning and nursery areas need tobe identified. The effects on indigenous and migratory game and forage fish species also need to be determined.

(2) The impacts of river bottom disturbances on water quality.

(3) The impacts of ship-induced waves on reptiles, amphibians and furbearing mammals.

(4) The impacts of the disturbances to the water column from ship-induced waves on the various life stages of fish and on the distribution, species diversity, and population size of game and forage fish.

(5) The impacts of noise from cracking and breaking ice on the distribution, species diversity and population size of game and forage fish.

(6) The impacts of ship-induced vibrations on the distribution, species diversity and population size of benthic communities.

(7) The impacts of dredging the Middle Neebish Channel and the disposal of the spoil on the distribution, size and structure of benthic and macrophyte communities.

(8) The increase in impacts on fish, benthos and macrophytes from disturbances to the water column and the bottom substrate from induced waves, propeller-generated ice being driven into the river bottom, propeller wash, noise from cracking and breaking ice and large ice chunks gouging the bottom at spring breakup as a result of widening the Middle Neebish Channel to accommodate two-way traffic.

(9) The impact of a spill of oil or other hazardous substance on the river ecosystem.

(10) The impact of the winter navigation program on wetlands.

(11) The impact of the winter navigation program on recreational ice fishing.

(12) The impact of shoreline riprapping on fish and wildlife habitat.

(13) The impact of disrupting the cross channel movement of wildlife.

Placing appropriate restrictions on vessel displacement and speed in winter to reduce ship induced pressure waves will:

(1) Reduce current generated disturbances to the river bottom substrate, benthic communities, and spawning and nursery areas of fish.

(2) Reduce currents which cause stresses on fish communities.

(3) Reduce the dangers to recreational ice fishermen and other winter sports enthusiasts.

(4) Reduce shoreline erosion and shoreline property damage.

Installation of a traffic control system at the Middle Neebish Channel would permit the single lane to be used by up and down bound traffic. This will:

(1) Eliminate the need for initial and long-term maintenance dredging and spoil disposal. Adverse effects on fish and benthic communities would be avoided.

(2) Reduce the area influenced by ship-induced waves through forced speed reduction, thereby minimizing the impact on benthic communities, fish spawning and nursery areas and lessening the physical stresses on fish communities.

(3) Reduce the amount of energy used by the project.

Terminating winter transportation of oil, hazardous materials and toxic substances in ice covered connecting channels until an effective plan is developed that will provide shorter response times, better containment methodologies and more immediate and better cleanup procedures in the flowing waters of the St. Marys River will:

(1) Eliminate the long-term widespread damages to fish and wildlife habitat that can be expected from a possible spill into ice covered flowing waters.

Enhancing the fishery of the St. Marys River can be accomplished by totally closing the West Neebish Channel to commercial navigation and recreating the West Neebish rapids from the rock material presently stored in the original rapids. This can be done by installing a traffic control system which would allow up and down bound traffic to share the present 27.5 foot deep Middle Neebish Channel for year-round navigation. Studies should be initiated to determine the relative fishery value of the two channels. The rapids would provide spawning habitat to numerous species of fish including rainbow trout, brown trout, lake herring, lake whitefish, walleye and possibly lake sturgeon, splake, and coho salmon. In addition to its biological importance, the restoration of those rapids would add a different kind of recreational fishing opportunity to the lower portion of the St. Marys River system.

F. Recommendations

The following recommendations supplement those listed previously for the Great Lakes Basin, Part F.

(1) Limit the use of large displacement vessels or restrict the speed of all commercial vessels during the period of extended navigation through the entire St. Marys River system (Iroquois Point at Lake Superior to Detour, Michigan). After the results of studies described in Great Lakes Basin, Section, Part F(4) become known, more specific recommendations can be given.

(2) With the exception of a short parking area, no channel enlargement should be done in the Middle Neebish Channel. An alternative to dredging would be the implementation of a traffic control system consisting of traffic lights and a parking area midway in the Middle Channel to allow up and down bound ships to pass each other.

(3) If, as a consequence of winter traffic demands, the Corps must pursue Middle Neebish Channel dredging to provide simultaneous two-way traffic, we would like to investigate intensively the feasibility and desirability of restoring the original rapids habitat to the West Neebish Channel. There is opportunity to restore significant rainbow trout, herring, and whitefish spawning habitat here.

IV. LAKE MICHIGAN - MAIN LAKE, MAJOR BAYS, STRAITS OF MACKINAC

A. Description of Area

The Lake Michigan Basin extends approximately 350 miles from north to south and is about 270 miles wide. The basin is the only one of the Great Lakes Basins that lies entirely within the United States. The land area adjacent to the lake is located in parts of Michigan, Wisconsin, Indiana, and Illinois. Approximately 62% of the basin is in Michigan, 32% in Wisconsin, with the remaining 6% shared by Indiana and Illinois. (See Figure IV-A-1)

The basin contains over 45,330 square miles of land. The Lake has a surface area of 22,300 square miles, making a total basin area of 67,630 square miles.

The Straits of Mackinac connect Lakes Michigan and Huron. The narrowest portion, between the upper and lower peninsulas of Michigan, is about 4-1/2 miles. Normal flow is from Lake Michigan to Huron, but the area is broad and deep, and both lakes have the same water surface elevation. The area is generally ice-covered throughout much of the winter.

Two ship channels pass through the Straits. One channel passes between Mackinac and Round Islands and the other between Bois Blanc Island and the Lower Peninsula of Michigan.

Shoal removal work has taken place in both channels. The channel between Mackinac and Round Islands has a depth of 30 feet, a

width of 1,250 feet and a length of 3,500 feet. The Poe Reef Shoal has a depth of 30 feet and an overall area of 120,000 square yards. The most recent work, authorized by Congress in 1956 to provide St. Lawrence Seaway depths, was completed in 1962.

Lake Michigan open waters are of generally high quality displaying only minor occurrences of degraded water quality that fails to meet the objectives in the Water Quality Agreement of 1972. Three problem areas identified as having significant water quality problems are Milwaukee Harbor, Green Bay and the Indiana Harbor Ship Canal.

The Milwaukee Harbor area is characterized by high coliform bacteria counts, high BOD, low dissolved oxygen, and high suspended solids from stormwater and combined sewer overflows. A study is underway for deep tunnel storage and treatment of combined sewage. There is also an ongoing demonstration project for treating overflows by chemical coagulation and activated carbon. Interceptor sewers have been constructed.

Lower Green Bay has been identified as a polluted area influenced by the highly industrialized and populous Fox River Valley. Dissolved oxygen levels are low and have generally been decreasing over the past thirty years. Strict control of point source discharges has produced recent improvements. During warm weather, critical dissolved oxygen conditions are common in the Fox River and extend 2-3 miles into Green Bay. During cold weather, particularly under ice cover, low oxygen conditions extend about 30 miles into the Bay. Phosphorus concentrations are high. In the vicinity of the Fox River mouth large areas of sewage sludge are found in bottom sediments.

The Indiana Harbor Ship Canal is the main source of pollution in the Calumet area of Lake Michigan. It carries effluents from three municipal treatment plants, East Chicago, Gary, and Hammond, Indiana. Industrial discharges from Atlantic Richfield, E. I. DuPont, Inland Steel, Union Carbide, United States Steel and Youngstown Sheet and Iron Tube are also present.

As industrial development and population increased along the Great Lakes and tributary streams, concern was expressed over the possible harmful effects of open-water disposal of polluted dredgings from navigation channels in harbors. The Chief of Engineers, in compliance with Executive Order No. 11288, authorized initiation of a "Pilot" study in 1966 to determine feasibility of alternative dredging disposal practices for Great Lakes harbors. This study provided Congress with the information to enact Public Law 91-611 (the River and Harbor Act of 1970), authorizing the Corps of Engineers to construct, operate, and maintain facilities to confine polluted dredged materials for a period of ten years to protect and improve the water quality of the Great Lakes.

At present, eleven Wisconsin harbors on Lake Michigan have sediments classified as polluted by the U. S. Environmental Protection Agency. These sediments therefore, require confinement. Confinement facilities are complete at Milwaukee, Manitowoc, and Kenosha. (The Milwaukee facility services Milwaukee and Port Washington; the Manitowoc facility, Manitowoc and Two Rivers; and the Kenosha facility, Kenosha and Racine.) Sites are being analyzed and public involvement solicited prior to site selection for Sturgeon Bay, Wisconsin, and for Menominee-Marinette, Michigan and Wisconsin. The proposed facility at Sheboygan, Wisconsin, has undergone constructibility review. Detailed design

is proceeding for a facility at Kewaunee, Wisconsin. Green Bay's facility is presently under construction.

Lake Michigan, because of its north-south orientation and 300-mile length (118 miles maximum width), can have ice formation and deterioration simultaneously. The period of extensive ice formation begins about the last week of January and continues until around the third week of March. During a severe winter, ice may cover 80 percent or more of the surface. Generally, the northern half of the lake contains the heaviest ice concentration throughout the winter.

The circular surface current patterns of the southern basin distribute drift ice along the shore, and even during a mild season, the drift ice is consolidated and can extend from shore out into the lake a distance of 10 to 15 miles. The distribution of ice, particularly pack ice, is primarily governed by wind and current patterns.

Some winter shipping has historically occurred in the southern half of the lake with oil and petroleum product deliveries to Michigan and Wisconsin ports from refineries located near Chicago.

Lake Michigan harbors which are proposed for year-around traffic are Escanaba, Green Bay, Port Washington, Milwaukee, Chicago, Calumet, Indiana, Burns Waterway, Gary, Muskegon and Ludington. Each of these harbors will be discussed separately.

B. Description of Project

As a result of improvements in selected harbors of Lake Michigan additional icebreaking and vessel traffic on the lake itself

are anticipated. Areas in which icebreaking will be required include Green Bay, Little Bay de Noc, Grand Traverse Islands and Beaver Island. Several additional icebreakers will be added to the Coast Guard fleet requiring new mooring facilities. These may necessitate dredging projects.

The operational measures proposed for implementation of extended season navigation on the Lake Michigan portion of the system are:

Icebreaking

Icebreaking will be required on the main lake, at harbor entrances, in the harbors, in the tributary lakes and rivers and in the major bays. Ice forms include sheet, drift and pancake ice. Icebreakers will be of two types: deep draft polar (Type B) and shallower draft (Type C). Icebreaking tugs will be used in the harbors. Type B icebreakers would be stationed at Milwaukee and Chicago. Type C breakers would be stationed at Sturgeon Bay and Milwaukee, Wisconsin, and at Escanaba and Traverse City, Michigan.

Icebreaker Mooring Improvements

The additional icebreakers would need mooring facilities and pier space. In some locations additional facilities are not needed. Specific locations and detailed plans are not available at this time.

Vessel Traffic Control

Vessels in transit will be monitored through a series of preselected check points. Traffic control is designed to prevent

collisions and groundings. The vessels will check in with a traffic center.

Ice/Weather Data Collection/Dissemination Systems

An Ice Navigation Center was established for the Demonstration Program. This center receives and disseminates information on ice conditions, weather and related topics.

Aids to Navigation

These developments include the use of Loran C, navigation lights, beacons and radar reflectors. Four permanent navigation lights will be constructed and located in Green Bay. These facilities are rather small and will be located on land.

Ice Control Structures

These structures are the proposed ice booms. Ice booms are floating logs or metal cylinders chained together and anchored to the bottom. In Lake Michigan these structures will be placed at several harbors to keep drift ice from clogging the entrances and making them impassible. The anchors will be left in place year-around, but the floats will be removed in spring and replaced in fall.

Air Bubbler Systems

These developments consist of long perforated pipes, a supply pipe and air compressors. The air pressures used in the system would be between 10 and 15 psi, a relatively low pressure. They

are not designed to keep an area ice free, but to reduce the thickness of ice so it can easily be broken. In Lake Michigan bubblers are proposed along docks and channels. Bubbler orifices are spaced at approximately 20-foot intervals.

Dredging

Dredging proposed for Lake Michigan winter navigation includes that amount needed in harbors to accommodate icebreaker facilities. Most dredging would occur in harbors where polluted spoil may be present. Plans include dredging deep draft channels from the regular navigation channel to mooring facilities. If the spoil is determined to be polluted, it must be deposited in confined spoil areas.

Compensating Works

There will be no compensating works on Lake Michigan. The St. Clair-Detroit River compensating works will have a minor effect on the water level of Lake Michigan. The compensating works will be designed to minimize the effects of ice booms at the head of the St. Clair and Detroit Rivers. If this is accomplished there should be no adverse effects on the fish and wildlife resources of Lake Michigan.

Shoreline Protection

There presently are no proposed shoreline protection measures for the Lake Michigan area. Studies are underway to define areas of shoreline erosion and structure damage.

Island Transportation Assistance

Transportation assistance is proposed for the Beaver and Washington Island ferries. These ferries have run all year in the past and are expected to continue with only occasional assistance.

Connecting Channel Operational Plans

In the Straits of Mackinac, the operational plan calls for icebreaking as needed.

Water Level Monitoring

Monitoring will be done in the connecting channels. There would be no effects on fish and wildlife resources.

Vessel Speed Control and Enforcement

The U.S. Coast Guard is responsible for the control and enforcement of vessels and their speed. The Coast Guard sees no need to change present speed limits because shoreline damages and erosion are the responsibility of the vessel operator. Cause of damage is determined by the Coast Guard.

Safety/Survival Requirements

These criteria have been developed to promote safe vessel operation in all United States water. For vessels operating in ice, the criteria are explicit about hull strength, power plant size, strengthened steering mechanisms, propellers and other special gear. There also are special criteria for oil and hazardous substance transports. Enforcement of these criteria will reduce the probability of accidents and serious spills. Vessels do

and will continue to operate that are not in compliance with these criteria. No additional regulations or enforcement are proposed in the plan.

Search and Rescue Requirements

These requirements will not affect and wildlife resources.

Oil/Hazardous Substance Contingency Plans

The Coast Guard is the designated responsible agency for these plans on the Great Lakes. These plans include one stockpile of materials used to contain spills located at Cleveland. A Regional Response Team also exists and the Service is a member. The National Strike Force, a highly trained Coast Guard unit, has a four-hour response time in the Great Lakes area. The actual cleanup of a spill is contracted to private companies. Oil, hazardous materials and toxic substance spills are a potential source of major adverse environmental impacts from this project.

Vessel Waste Discharge (Non-human) Requirements

These requirements and standards have been set and enforced by EPA. These requirements include the equivalent of secondary treatment. No wastes are to be discharged into the waters of the lakes. The problem of disposing of these wastes in special harbor facilities is being studied.

Environmental Plan of Action

The Fish and Wildlife Service and the Corps of Engineers have determined that much information is needed to make a precise

evaluation of project effects. The EPOA is an attempt to acquire and evaluate the needed information and predict the effects of the project. The plan will provide for monitoring project developments to verify predictions, and will culminate in a report recommending ways to eliminate or minimize adverse effects.

C. Fish

1. Without the Project

The Lake Michigan fishery has undergone drastic changes in population structure over the last thirty years. Changes in fish stocks since 1945 have been extreme and are not completely understood. Major changes have occurred as a result of intensive and selective commercial fishing, introduction of exotic species and environmental changes (primarily pollution).

The most dramatic change was the collapse of the lake trout population between 1945 and 1949 caused by increased commercial exploitation of the lake trout and by sea lamprey predation. The burbot population was also depleted by the sea lamprey. Seven species of ciscoes (chubs) upon which the lake trout and burbot fed were affected by the decrease in predation. The commercial fishery emphasis changed from lake trout to the ciscoes and at the same time, the sea lamprey increased its parasitism of the larger ciscoes and lake whitefish. As a result of these pressures, the two largest species of ciscoes (chubs) (*Coregonus johannae* and *C. nigripinnis*) became virtually extinct, and the four species of intermediate size (*C. alpenae*, *C. kiyi*, *C. reighardi* and *C. zenithicus*) became seriously depleted by 1960. As the supply of ciscoes decreased in the late 1950's, the

commercial gill net fishery declined. During the decline of the large deepwater ciscoes, the small slow-growing ciscoes, known as bloaters (C. hoyi), increased and became abundant by the mid 1950's. At the same time, alewife and smelt populations increased and became abundant in Lake Michigan. The bloater and the alewife then became the target species of the trawl fishery which existed in the late 1950's. The intensive trawl fishery, coupled with the increase in size of the bloaters, making them susceptible to the gill net fishery, and sea lamprey predation led to the decline of that fishery in the early 1960's.

During the mid 1960's, the alewife population expanded and the alewife became the most abundant and widely distributed species. Because the alewife formed dense schools and inhabited various sections of the lake during the different seasons, it influenced the populations of all other species. During the winter, alewives concentrate in deep waters where the temperature is warmest (3.9^{o}C). Traditionally, the deepwater was occupied by C. kiyi which was abundant in the mid-1950's, but had become greatly reduced by 1960-61 and was nearly extinct by 1964. In the early spring, the alewives begin to move toward the shore to spawn and pass through the region occupied by the bloater (C. hoyi). The alewives also pass through the intermediate zone during the autumn as they return to deep water. The lake herring, emerald shiner and bloater populations sharply decreased in abundance as alewives increased.

Yellow perch, which also occupied the inshore zone, became more abundant as the alewives increased, presumably as a result of the increased food supply in the form of young

alewives. The temporary increase in yellow perch population levels resulted in increased commercial fishing pressure. This fact and the establishment of large alewife populations in shallower waters of the lake during the summer displaced the yellow perch from the shallow zone during the spawning and hatching period. It was suggested that the alewife, in part, caused the yellow perch population to decline during the period 1965-1966. The smelt, which also occupied the inshore areas of the lake, sharply declined as the alewives increased in abundance.

The most recent change in Lake Michigan fish stocks concerned massive trout and salmon stocking programs initiated by the states of Michigan, Indiana, Illinois and Wisconsin. Rainbow, brook, brown and lake trout, and coho, chinook and Atlantic salmon have been introduced in Lake Michigan. The objectives of these stocking programs are to provide fish to prey on the the alewife and to reestablish a sport fishery in the lake. The programs have had mixed success. A dynamic sport fishery has been established, but requires continuous restocking to maintain populations. Although no massive alewife dieoffs have occurred since the stocking programs were initiated, alewife production remains high and the cisco population low.

Salmonid fishes are the primary target of sport fishermen in Lake Michigan. Yellow perch, northern pike, walleye and smallmouth bass are also preferred. Rainbow smelt and white sucker are harvested during spring spawning runs. Estimated 1976 summer sport harvest of trout and salmon from Wisconsin waters was over 200,000 fish. Summer yellow perch catch in Wisconsin waters by sport fishermen was estimated at approximately 54,000 fish.

Species of importance to the commercial fishery of Lake Michigan include lake whitefish, yellow perch, smelt, alewife and carp. Nearly 40 million pounds of alewives and three million pounds of lake whitefish were landed in 1974. Yellow perch harvest has averaged approximately 450,000 pounds in Green Bay during the past five years. Chubs are fished commercially on a permit basis for stock assessment.

The longjaw cisco (C. alpenae) is a Federally listed endangered species which was once present in deep waters of Lake Michigan.

2. With the Project

The effects of vessel movement on fish in deep water during winter are not known.

The following is a list of various project segments with anticipated effects on the fishes of Lake Michigan.

Icebreaking

Icebreaking will take place on the open lake, in harbors, connecting channels, rivers and bays. Effects are thought to be concentrated in near-shore areas, shallow bays and harbors. Propeller wash could cause sediments to become resuspended displacing benthic organisms. Fish would be exposed to turbulent currents causing additional stress. Loss of fishery resources could result from both effects.

Icebreaker Mooring Improvements

Additional icebreakers would need mooring facilities and pier space. An access channel may be needed between the

navigation channel and the pier. The project plan does not give enough detail to determine what resources may be affected. We assume that these mooring facilities will be located at or near existing Coast Guard facilities. More detailed discussions and recommendations are contained in the appropriate harbor sections of this report.

Ice Control Structures

Ice booms are proposed in Lake Michigan at harbor entrances. A more detailed discussion will appear in the appropriate harbor sections. Ice booms do not appear to have significant effects on fishery resources. The anchors will be buried in the bottom and left in place. This could cause minor losses of habitat.

Air Bubbler Systems

The air bubblers, if operated as described in the proposed plan, should not have significant effects on the fishes of Lake Michigan. Air pressures would not produce an air curtain effect because the jets are too far apart and the bubbles would not spread far enough to meet. Currents generated would probably not be strong enough to resuspend bottom sediments. The operating plan does not state whether the bubblers would be operated continuously or intermittently. There might be a local increase in dissolved oxygen levels. Other effects will be discussed in the appropriate discussion sections.

Dredging

Fishery resources of Lake Michigan would be adversely affected by dredging of access channels for icebreaker mooring facilities. Placement of spoil could also cause adverse effects. A more detailed discussion of this development will appear in the appropriate harbor sections of this report.

Island Transportation Assistance

The described icebreaking assistance for the Beaver and Washington Island Ferries should have insignificant effect on the fisheries of Lake Michigan. The waters traversed are deep and are thought not to be subject to sediment resuspension. Some localized sedimentation might occur near the ferry slips.

Vessel Speed Control and Enforcement

This part of the plan could have a profound effect on fishery resources in the basin. Vessel speed is one of the factors controlling the pressure waves that can occur in confined channels. Several of these areas occur in Lake Michigan, including the entrance to Green Bay Harbor, vessel passages through the Grand Traverse Islands and the shoal area in Muskegon Lake. Excessive vessel speed (even if within the legal limit) has caused severe environmental damages in other parts of the system. Fishery resources have been eliminated directly and their habitat and food supply reduced. Without adequate vessel speed limits and enforcement at the above-mentioned critical areas, fishery resources could be severely affected.

Vessel Operating and Design Criteria

Presently there are ships operating in the Great Lakes which do not have the modifications outlined in the Coast Guard's operating and design criteria. Fishery resources and human lives are imperiled because ships have not been modified to include needed safety features. Strict requirements, incorporating these modifications for winter navigation, would reduce the chance of a major disaster.

Oil/Hazardous Substance Contingency Plans

The lack of compliance with the operating and design criteria causes the probability for a spill to increase. Existing contingency plans are untried in winter. Several of the described contingency plan segments do not adequately protect fishery resources. The National Strike Team response time of four hours is inadequate for a spill in the flowing waters of the connecting channels. A spill could travel a long distance downstream in that time. The containment booms have not performed satisfactorily even under more ideal conditions than found in winter. Response time for the regional teams is also too long. By the time cleanup equipment is on the site, the spill can extend downstream or downwind a considerable distance. Fish habitat could be irreparably damaged. Fish eggs in the area would be destroyed. Spawning habitat could be made unusable even if fish eggs are not present. A spill also could destroy the benthic community since heavier petroleum products will sink to the bottom. Benthos are an important food source for fish. Existing cleanup capabilities do not appear adequate to prevent serious environmental damage.

Environmental Plan of Action

Much information concerning fishery resources is needed to make a more detailed and accurate evaluation of project impacts. Accurate fish stock assessments, spawning area surveys and other baseline studies are proposed in the EPOA. The EPOA will also provide for monitoring studies and will result in recommendations to eliminate or minimize adverse environmental impacts.

D. Wildlife

1. Without the Project

The diverse habitat types of the Lake Michigan Basin support a rich and diverse fauna. Over 60 species of mammals may be found in the basin, some of which are very important to man as game animals and furbearers. These include white-tail deer, black bear, snowshoe hare, eastern cottontail, gray, fox and red squirrel, raccoon, red and gray fox, coy-ote, beaver, river otter, mink and muskrat. Over 25 species of reptiles and 20 species of amphibians are also found. Over 250 species of birds have been observed in the Lake Michigan Basin.

The shoreline, islands, wetlands and shallow waters provide feeding, resting and nesting habitat for millions of water-fowl, shore and wading birds, colonial nesters, and song-birds. Waterfowl commonly seen in the basin include the whistling swan, Canada goose, mallard, pintail, black duck, gadwall, American widgeon, northern shoveler, blue-winged and green-winged teal, wood duck, redhead, canvasback, ring-

necked duck, lesser and greater scaup, common goldeneye, bufflehead, oldsquaw, black, white-winged and surf scoter, ruddy duck and the common, red-breasted and hooded merganser. Common loons migrate along the shores of Lake Michigan and winter in open water in the southern part of the lake. Herring gull, ring-billed gull, common tern, Forster's tern, Caspian tern, black tern, black-crowned night heron, double-crested cormorant, snowy egret, cattle egret, and great blue heron nest in the Lake Michigan basin. The only known Caspian tern, snowy egret and cattle egret nesting colonies in the U.S. Great Lakes recently were recorded in northern Lake Michigan. The double-crested cormorant, classified by Wisconsin as endangered and Michigan as threatened, is limited to four known nesting colonies in the Great Lakes, three of which are in Lake Michigan.

Important migration routes for birds of prey, shore birds and passerines are located along the shoreline of Lake Michigan. Many waterfowl including scaup, oldsquaw, common goldeneye, scoters, bufflehead and common and red-breasted mergansers winter in open water areas of the lake, especially in harbors and near power plants.

Hog, Gravel, and Spider Islands in northern Lake Michigan, are National Wildlife Refuges used by gulls and terns for nesting.

Federally listed endangered species which may be found in the Lake Michigan Basin are the American and Arctic peregrine falcon and Kirtland's warbler. The bald eagle is listed as endangered in Illinois and Indiana and threatened in Michigan and Wisconsin.

2. With the Project

Operational measures considered necessary for extended season operation on Lake Michigan could produce changes in the environment which would affect wildlife resources.

The following is a listing of the various segments of the project with anticipated effects on the wildlife of Lake Michigan.

Icebreaking

Icebreaking will take place throughout the system. The effects are concentrated in near-shore waters, shallow bays and harbors. Propeller wash could cause currents which resuspend sediments and cause bottom scour displacing benthic communities used as food by wintering waterfowl and shore-birds. Icebreaking may also create open water areas which would attract and hold wintering birds.

Icebreaker Mooring Improvements

Additional icebreakers would need mooring facilities and pier space. An access channel may be needed between the pier and the navigation channel. The project plan does not give enough detail to determine what resources may be affected. We assume that these facilities will be located at or near existing Coast Guard facilities. More detailed discussions and recommendations are contained in the appropriate harbor sections of this report.

Ice Control Structures

Ice booms are proposed in Lake Michigan at harbor entrances. A more detailed discussion of these structures will appear in the appropriate harbor segments of this report. A small amount of open water may remain behind the booms. This may be attractive to waterfowl but will be over relatively deep water and, therefore, be used only for resting. The anchors will be buried in the bottom and left in place. This could cause minor losses of bottom habitat and benthos.

Air Bubbler Systems

The air bubblers, if operated as described in the proposed plan, should not have significant effect on wildlife resources. This would be true if bubblers do not create areas of open water. Bubblers, operated at low air pressures, would probably not resuspend bottom sediments. The operating plan does not state whether the bubblers would operate all the time or intermittently.

Dredging

Dredging may be necessary for the proposed icebreaker mooring facility. Both dredging of channels and associated spoil placement would affect the wildlife resources.

Vessel Speed Control and Enforcement

This development can have a profound effect on wildlife habitat within areas of pressure wave generation. The shore-

line, wetlands and shallow water areas are particularly vulnerable to this phenomenon. Vessel speed is one of the factors governing the generation of these pressure waves. The areas where these waves can be generated include the entrance to Green Bay Harbor, vessel passages through the Grand Traverse Island, and the shoal area in Muskegon Lake. Excessive vessel speed has caused severe damages in other parts of the system. Wildlife habitat has been eliminated. Without adequate vessel speed limits and enforcement at the above-mentioned critical areas, wildlife habitat could be severely affected.

Vessel Operating and Design Criteria

As described in the fish section, there are ships presently operating in the Great Lakes which do not have the modifications outlined in the Coast Guard's operating and design criteria. Wildlife resources, especially waterfowl, are particularly vulnerable and imperiled because these ships are not modified and are subject to a higher probability of accident. Strict requirements, incorporating these modifications for winter navigation, would reduce the chance of a major disaster.

Oil/Hazardous Substance Contingency Plans

Existing contingency plans are untried in winter. Several of the described plan segments do not adequately protect wildlife resources, particularly waterfowl. The response times for the National Strike Team and the regional teams are too long. By the time the equipment is on site, the spill could extend a long distance, especially when carried

by strong currents or driven by winds. Heavier petroleum products will sink to the bottom smothering benthic food organisms. Vegetation emerging in spring could also be affected by a winter spill. In addition to long response times, some cleanup equipment is less than satisfactory. More effective equipment should be obtained and conveniently stockpiled throughout the basin.

Environmental Plan of Action

As was described in the fish section, the plan of action is designed to acquire information that will allow a detailed and accurate evaluation of project impacts.

E. Discussion

Possible impacts of extending the navigation season have been mentioned in a qualitative manner in previous sections. Much information is not presently available to make quantitative predictions about the project effects on fish and wildlife populations and habitats.

Vessel passage through constricted areas of northern Lake Michigan and tributary lakes could cause movement of bottom materials where depths are less than 40 feet. Although lake trout are not currently reproducing, there is hope that in the future rocky shoals such as those found off islands in northern Lake Michigan will again support self-sustaining populations. Major lake whitefish spawning grounds have been identified in North Bay, Door County, Wisconsin and Big Bay de Noc, Delta County, Michigan. Other whitefish spawning areas in the northern part of the lake are likely to be found. Since both the lake trout and lake whitefish are fall spawners, winter disturbance of sediments would

affect ice fishing which occurs near some of the islands and off the mainland. Spills or discharges of oil hazardous materials and toxic substances would adversely impact the eggs or larvae of lake whitefish. Production of benthic organisms could also be reduced.

Effects of dredging for new icebreaker mooring facilities may include disruption of fish migration and spawning, reduction in production of benthic organisms, mortality to fish eggs and larvae and destruction of aquatic and terrestrial habitat. Sediments in several Lake Michigan Harbors are polluted and can only be disposed of in impermeable containment facilities.

Icebreaking in nearshore areas has the same effects as previously described for vessel passage with the addition of creating unsafe ice conditions for sport and commercial ice fishing. Access to traditional fishing sites might be hampered by maintaining vessel tracks throughout the winter.

The Great Lakes' few sheltered open water areas with an adequate food supply are important to wintering waterfowl. Waterfowl from a widespread breeding area are concentrated in and near them during winter. Waterfowl attracted to these areas feed on small fish and benthos. If this food supply is depleted they may be unable to find another protected area with adequate food. The nutritional state of migrating waterfowl in fall and early winter appears to be very important. Reproductive success depends on adequate nutrition in the pre-reproductive period of spring migration. If fish and benthos are reduced by winter shipping waterfowl reproductive success might be affected.

The impact of reduced benthos and fish life is not limited to waterfowl. Gulls, terns, herons, grebes, ravens, cormorants, crows and terrestrial carnivores scavenge dead fish and actively pursue live ones. Gulls, terns, mergansers, grebes and cormorants absolutely require fish. There are a number of heron, cormorant, tern and gull colonies in Lake Michigan.

The potential for elimination of benthos, fish and wintering waterfowl from large parts of the harbors--or well beyond--seems greater from discharges and spills than from the mechanical impact of ship passage. The impact would depend on the timing, substance, weather, clean-up effectiveness and other factors. The loss of a year-class of small fish from could seriously affect the ability of other fish, as well as gulls, terns, cormorants and herons, to survive.

Spills and discharges are known to be harmful to fish and wildlife. Both internal (ingestion of contaminated food) and external factors result in increased mortality. For example, birds in the water at the site of petroleum spills lose both insulation and buoyancy and, unless only very lightly oiled, almost always die from hypothermia, drowning or poisoning. Even with the best available human intervention a very low percentage of oiled birds survive.

Winter complicates clean-up efforts and a spill in or near a harbor would be expected to contaminate the shoreline. Oil, on the water or on shore, can affect bird populations. Recent research indicates that even small amounts of oil from a nesting bird's plumage can kill the embryos in eggs. Thus, even if the oil is not fatal to the individual bird it could reduce that bird's reproductive success.

Waterfowl congregate in harbors that have both open water and protection from wind and waves. At the same time, winter is a period of great stress due to scarce food supplies and increased energy requirements for body maintenance. Further stresses may result from the crowding of the flock and the unavailability of desirable habitat. Additional expenditures of energy that have no return value will be required as birds flee oncoming ships. There will be additional forced movement to harbor and water areas where conditions are less favorable.

Whether this anticipated degradation of the environment for birds will be directly or indirectly harmful is not known. It is certain, however, that additional stress will have an adverse impact.

F. Recommendations

Recommendations applicable to Lake Michigan proper are those listed previously for the Great Lakes Basin, Part F.

V. LAKE MICHIGAN HARBORS

A. Escanaba Harbor, Michigan

1. Description of Area

Escanaba Harbor is located on the western shore of Little Bay de Noc, a northerly extension of Green Bay in Delta County, Michigan. Extensive ore docks and wharves have been built at Escanaba, but there are no Federal harbor improvements. The harbor moves more cargo than any other harbor in the Green Bay area. Iron ore is the primary exported commodity. Coal and petroleum products are received.

Little Bay de Noc is approximately 14.4 miles long with an average width of 3.3 miles. Maximum depth is 99 feet. Surface area is 27,918 acres, 52 percent of which has a water depth of 24 feet or less. The substrate in shallow water is predominantly sand, with rock and rubble along the north and west shores. The bottom in deep water is silt.

Ice formation generally begins in December and ice is present well into April. Ice cover on the bay is usually 100 percent from mid-January until late March or early April. Ice thickness averages two feet, but may be much greater along the ship channel where broken ice is continually pushed under the sheet ice.

Water in Little Bay de Noc off Escanaba is moderately hard, alkaline and usually at or near 100 percent oxygen saturation. Total alkalinity in the ice-free period of 1974 ranged from 87 to 117 mg/l, pH was 8.0-8.5 and Secchi disc transparency ranged from 1.7 meters in April to 3.8 meters in July.

Waters of Little Bay de Noc generally meet water quality standards for fish and aquatic life with the exception of the mouth of the Escanaba River. Degraded conditions are attributed to pulp and paper wastes. Bottom fauna at the mouth of the Whitefish River indicated moderately degraded conditions. Improvements resulting from stricter point source control are being seen in the entire Green Bay watershed.

2. Description of Project

Improvements for five separate docking facilities in Little Bay de Noc include installing bubblers and operating icebreaking tugs (Figure V-A-2-1). A 1000-foot bubbler would be installed perpendicular to the dock at the Holly Corporation oil tanks 3.3 miles north of Escanaba in 30-40 feet of water. Three 4000-foot bubblers would be installed in the slips adjacent to and immediately north of the Escanaba Generating Station on the north edge of the city. A 4000-foot bubbler would be installed at the C. Reiss Coal Company docks in the City of Escanaba.

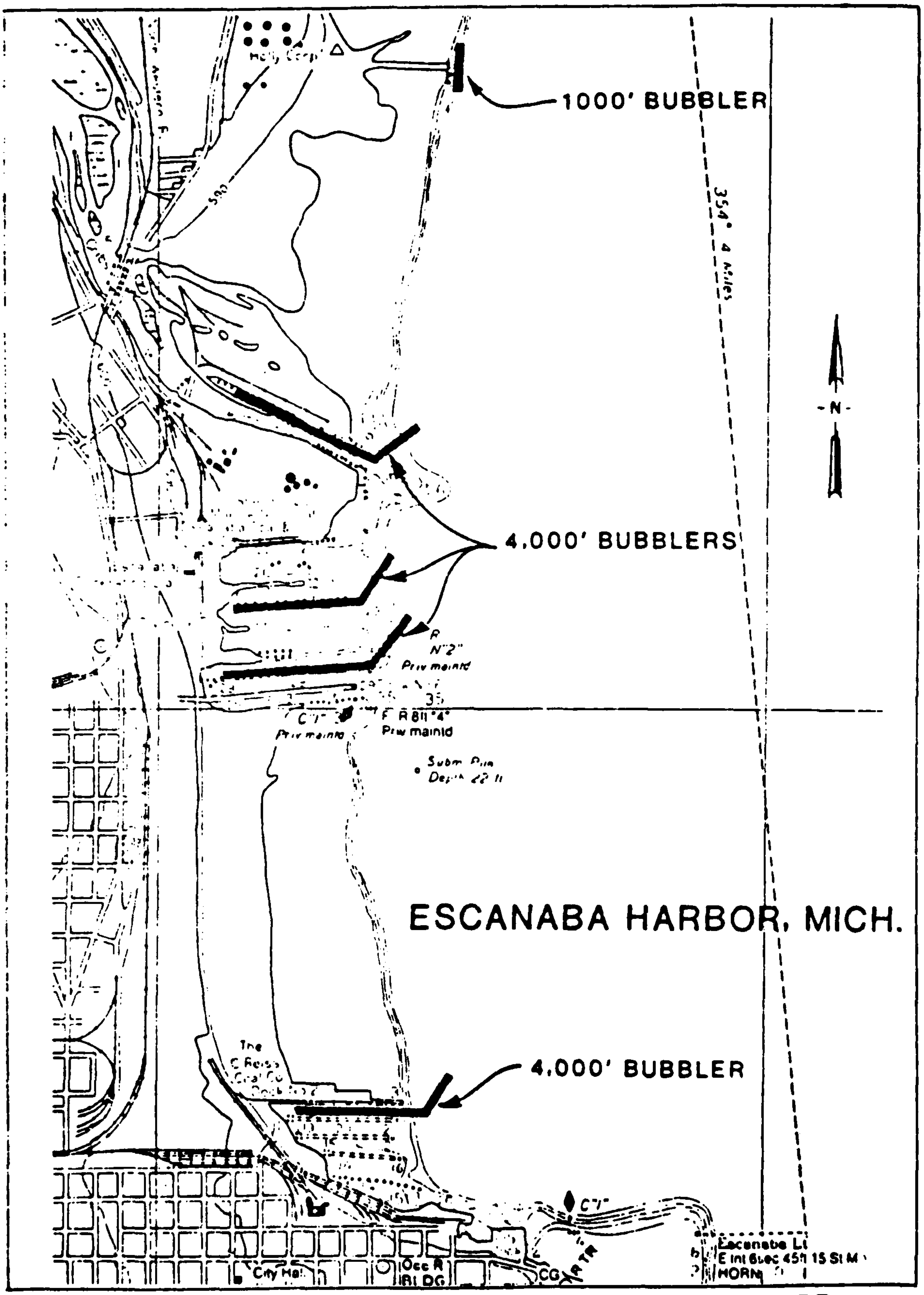

FIGURE
V-A-2-1

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Oil tankers travel into Little Bay de Noc unassisted until approximately February 1. Icebreaking assistance would probably be on an as-needed basis from the ship channel to the five docks with bubblers. After February 1 additional icebreaking might be required from the entrance to Little Bay de Noc to open water in the vicinity of the Grand Traverse Islands.

3. Fish

a. Without the Project

Little Bay de Noc supports a diverse population of coldwater, coolwater and warmwater fishes. Species include walleye, northern pike, yellow perch, smallmouth bass, brown, rainbow and lake trout, black crappies, coho and chinook salmon, rainbow smelt, and lake and round whitefish. Alewives are abundant in late spring and summer.

The Whitefish River, a major tributary of Little Bay de Noc supports naturally reproducing rainbow trout. In 1977 there was a good run of spawning-size walleyes but it is not known if spawning was successful. Northern pike and yellow perch spawn successfully in many of the small marshy tributaries along the western shore. A large wetland in the vicinity of Portage Point is also used by spawning northerns and perch. Michigan Department of Natural Resources biologists believe that lake whitefish spawn along the eastern

shore of Little Bay de Noc although specific areas have not been pinpointed. Smallmouth bass are believed to spawn in 2-20 feet of water over sand, gravel, boulders and rubble along both shores.

A major fishery management objective is to restore the walleye to the abundance of the late 1950's. Approximately 575,000 fingerlings and 1,400,000 walleye fry have been stocked since 1971. The intensive stocking effort appears to be making progress.

Coho and chinook salmon were stocked in the past, but the results have been disappointing. Cohos have not been stocked since 1972 and chinook stocking may be discontinued as well.

Brown trout fingerlings and yearlings have been stocked annually since 1971 and a good fishery exists for this species off the mouth of the Days River and on the reefs near Bladstone, nine miles north of Escanaba. Rainbow trout fingerlings and yearlings are stocked to supplement natural reproduction in the Whitefish River. Over 100,000 lake trout yearlings have been stocked annually in Little Bay de Noc since 1974. There is no evidence of natural reproduction, but survival and growth of stocked fish appears excellent.

Northern pike fry have been stocked in Little Bay de Noc in the past. Growth of northern pike in Little Bay de Noc is excellent in comparison to that occurring in other parts of Michigan.

Walleyes and yellow perch are the most sought after species year-round, with northern pike and brown and rainbow trout important seasonally. Ice fishing is almost exclusively for perch and walleyes and is concentrated along the west shore between Escanaba and Gladstone, in and around Portage Point, in the marina basin at Escanaba and along the eastern shore near Stonington. Between 200 and 300 ice shanties are on the ice during the December - March period.

Commercial fishing in Little Bay de Noc is limited to rainbow smelt and lake whitefish. Smelt are fished through the ice during January, February and March south of Escanaba. Smelt landings average approximately 475,000 pounds per year. The monetary value of the catch is approximately $14,250.

The longjaw cisco, Coregonus alpenae, a Federal and State listed endangered species, is not believed to occur in Little Bay de Noc.

b. With the Project

The operation of 5 bubblers and an ice breaking tug is not expected to alter the composition of fish species in Little Bay de Noc. All bubblers are located adjacent to existing docks and are not believed to affect major spawning or nursery areas. Water depths from the center of Little Bay de Noc to the docks range from 35 to 45 feet. An increase in turbidity and sedimentation resulting from icebreaking and ship traffic is not anticipated.

Winter ship traffic currently conflicts with sport and commercial fishing activities near Escanaba. Increased winter shipping will undoubtedly increase use conflicts. Much of the ice fishing effort for yellow perch occurs between Escanaba and Gladstone between the west shore and the vessel track.

A visit to the area on January 20, 1978 revealed most ice shanties north of Escanaba over 30-40 feet of water with some less than 100 yards from the broken ice. The broken ice in the center of the bay prevents easy access to another popular fishing spot near Stonington. Many fishermen who use snowmobiles to get to fishing sites do not cross the vessel tracks until the tankers stop running (usually in early February). Preliminary findings of a study done by the Bureau of Outdoor Recreation (now Heritage Conservation and Recreation Service) in 1976 agree that extended winter navigation will conflict with sport fishing, snowmobiling and other recreational activities on Little Bay de Noc. The extent of this disruption and amount of lost man-days have not been estimated.

Winter shipping also would have a disruptive effect on commercial fishing for smelt and whitefish near Escanaba. Fishing for smelt with trap nets is done just off Escanaba light and Sand Point. Netting generally does not begin until the tankers stop running.

If shipping were to continue year-round, this fishery could be completely eliminated. Assessment netting for whitefish does not begin until the vessel track closes in February. Year-round ship traffic would eliminate some netting locations and make access to east shore sites more difficult. Total elimination of the smelt fishery would result in an annual loss of approximately $14,250. It is difficult to estimate losses to the whitefish assessment program resulting from extending the navigation season.

4. Wildlife

a. Without the Project

The land around Little Bay de Noc and Escanaba is a composite of beaches, marshlands, upland forest and the urban-industrial areas of Escanaba and Gladstone. This diversity of habitat provides for many wildlife species. Mammals occupying the area include whitetail deer, black bear, coyote, gray and red fox, striped skunk, porcupine, eastern cottontail, snowshoe hare, eastern gray and red squirrel, raccoon, mink, river otter, beaver and muskrat. Birds include marsh and shore birds, waterfowl, hawks, owls and songbirds. Woodcock and ruffed grouse are found in upland areas. Eight species of reptiles and 14 amphibian species may be found in the Little Bay de Noc basin.

The shallow waters and shoreline marshes are important nesting, resting, and feeding areas for shore and marsh birds as well as waterfowl. A large cattail marsh just south of Escanaba supports nesting colonies of black and common terns and green herons. Diving ducks, geese and swans use the deeper, open water areas during migration. The western shores of Green Bay and Lake Michigan form a major migration route for many birds. Mink and muskrats, valuable furbearers, are locally abundant in coastal wetlands and river deltas. Beaver and river otter are common along rivers farther inland.

Little Bay de Noc is usually completely covered with ice in winter so waterfowl are confined to small open areas in the Escanaba River and at the generating station's warmwater discharge. Species commonly observed in winter include scaup, common goldeneye, bufflehead, herring gull and common merganser. Snowy owls may be seen in some years perched along open water areas.

Waterfowl hunting and trapping are popular fall activities in the Escanaba area, however, no estimates of waterfowl or furbearer harvest are available. Bird watching, wildlife photography and nature study are also popular.

Two species on the Federal Endangered Species list may be seen on occasion in the Little Bay de Noc basin. They are the peregrine falcon and Kirtland's warbler. The bald eagle, recently reclassified as a Threatened species, may also be seen.

b. With the Project

The wildlife species composition of the Escanaba area should not be significantly altered by the proposed project. However, adverse effects may be felt by the existing fauna. If the five bubblers result in additional open water, more waterfowl may be attracted. The possibility of mortality due to malnutrition when feeding areas become ice covered will be increased. An oil spill in winter also could produce high mortality because of the high density of birds in few open water areas.

Access to winter trapping areas on the eastern shore of Little Bay de Noc will be hampered by the maintenance of a vessel track by icebreaking. The extent of this disturbance is unknown.

5. Discussion

Although lake whitefish are not commercially harvested in Little Bay de Noc at present, there is potential for a controlled fishery. The adjacent Big Bay de Noc supports an intensive lake whitefish fishery and both bays are similar in many respects. Spawning and nursery areas in Little Bay de Noc have not been conclusively identified. Since lake whitefish spawn in November and December and hatching occurs in April and May, the eggs and newly hatched fry could be affected by increased turbidity and sedimentation. No winter and spring sampling has been done to locate lake whitefish spawning and nursery areas near Escanaba.

Vessel movement, particularly vessels breaking ice, may disturb adult fish so that under ice movement is increased and winter habitat areas are changed. In the Escanaba area this could affect the State's lake whitefish assessment program. This program could be used to monitor project effects. Commercial smelt netting is done in close proximity to the shipping lane off Escanaba and the annual harvest could be affected. Sport ice fishing areas and catch also could be affected. Little research has been done regarding impacts of vessel passage on fish movement in winter.

Sport fishermen apparently maintain what they feel is a safe distance from the ship track and are reluctant to cross it until shipping ceases. Additional broken ice tracks to docks proposed for winter traffic would place additional restrictions on where ice fishing could occur. Commercial smelt netting and whitefish assessment netting could be delayed or otherwise affected.

Spills of oil, hazardous materials and toxic substances present special problems under winter ice conditions. Low temperature causes some oil to congeal and sink to the bottom, where it can smother benthic organisms, fish eggs and larvae. Waterfowl are concentrated in limited open water areas in winter and are particularly vulnerable. The basin section and each lake discussion contain recommendations pertinent to these concerns.

Waterfowl can be induced to winter in an area by providing open water and food. Bubbler operation could result in patches of open water. If more waterfowl stay in an area than the food supply can support, malnutrition would cause mortality and increase susceptibility to parasites and disease.

6. Recommendations

(1) Conduct winter and spring fish and larva sampling studies to determine if proposed bubblers and vessel passage could adversely affect lake whitefish spawning and nursery areas.

(2) Conduct winter studies to determine the amount of ice fishing, location of prime fishing areas, catch-rate, access routes to fishing areas, and alternate areas for smelt and whitefish commercial netting.

(3) Confine winter ship traffic to that part of the harbor and Little Bay de Noc where the above studies indicate the least adverse impacts will result.

(4) Bubblers not commence operation until stable sheet ice has formed and operation be such that ice thickness is decreased but no additional open water is created.

(5) Areas of ice influenced by bubbler operation should be clearly marked to warn winter recreationists of possible unsafe ice.

B. Green Bay, WI

1. Description of Area

Green Bay Harbor is located on Green Bay at the mouth of the Fox River, in the City of Green Bay, Brown County, Wisconsin.

The authorized project at Green Bay provides for an outer channel about 11-1/4 miles long, 300 to 500 feet wide, and 26 feet deep. From Grassy Island, the project has a channel 24 feet deep to a point 1,700 feet upstream of the Chicago and Northwestern Railway bridge and 18 feet deep to DePere. There are three turning basins: the first, 24 feet deep at the mouth of East River; the second, 20 feet deep upstream of the Chicago and Northwestern Railway bridge; and the third, 18 feet deep at DePere.

Traffic in 1975 was 2,608,177 tons and consisted primarily of coal, petroleum products, cement, limestone, and general overseas cargo. The average annual traffic from 1966 through 1975 was 2,716,000 tons.

Water quality problems exist in lower portions of Green Bay and the Fox River and are principally related to wastes from industrial, municipal and agricultural sources. The lower Fox River, the main tributary to Green Bay, contributes most of the nutrients and organic and toxic substances found in lower Green Bay. The Fox River occasionally has

little dissolved oxygen for considerable distances upstream of its mouth. One of the most significant water quality problems of Green Bay is the excessive algal growth occurring in summer as a result of over-fertilization. The heavy pollution load received by Green Bay depresses the overall level of dissolved oxygen available to aquatic life throughout the year. Dissolved oxygen depletion is also apparent in the lower bay during later winter months when ice covers the area.

Degraded water quality in the form of high fecal coliform counts and other pollutants restrict the utilization of the lower Fox River and Green Bay as a public water source or recreation area. Low dissolved oxygen levels, heavy algal blooms, and pollutants have caused the disappearance of many desirable benthic species from the project area. A new sewage treatment plant at Green Bay and strict enforcement of effluent standards have produced recent improvements.

Ice up to four feet thick, usually covers lower Green Bay from December until April. Heated effluent from the Pulliam Power Plant at the mouth of the Fox River keeps a small area ice-free.

2. Description of the Project

Navigation lights and an icebreaking tug are proposed improvements to extend the navigation season in Green Bay Harbor.

3. Fish

a. Without the Project

Fish species diversity in the lower portions of Green Bay and the Fox River is not as great as that found in other portions of Lake Michigan.

Erosion, siltation, excessive rates of eutrophication, and destruction of wetlands have degraded fishery habitat. Winter and summer kills of fish due to oxygen depletion limit the numbers and species of fish.

During the spring,walleyes, northern pike, carp, and suckers move up the Fox River to spawn. In autumn, the Fox River attracts some of the fall-spawning salmonids which have been introduced into Lake Michigan; chinook salmon have been stocked in the Fox River at the DePere fairgrounds and have been observed clearing the DePere Dam and continuing upstream. Yellow perch are the most valuable commerical fish species in Lower Green Bay.

A popular ice fishing area is located west of where Duck Creek enters the bay. As many as 200 people reportedly used this area when fishing was good and weather conditions permitted. Snowmobiling occurs everywhere in the lower end of the bay. Frequently traveled routes are from residential areas near Long Tail Point to the Eagle's Nest Marina area, the eastern half of the lower bay, and leading to a county maintained trail at Bay Shore Park.

b. With the Project

Sediment disturbance will contribute to the already critical winter problem of low dissolved oxygen concentrations and will reduce benthic populations and productivity. Dissolved oxygen problems could be aggrevated if cargoes of hazardous materials, which can be oxidized, are spilled in the harbor or lower Green Bay.

Oil in the water column may be directly toxic to fish and other aquatic organisms. Also, low temperature causes some oil to congeal and sink to the bottom where it could smother benthic organisms and coat bottom materials, preventing successful fish reproduction.

In winter, sport fishermen generally congregate around the mouth of Duck Creek and other tributaries along the west shore. Commercial fishermen, however, concentrate their efforts in the deepest waters of Green Bay, including the shipping lanes. Thirty or more fishermen may participate in the winter commercial fishery for yellow perch and lake whitefish. Estimates of the winter harvest are not readily available. Winter vessel traffic could prevent fishermen from working their traditional fishing areas.

Vessel movement, particularly vessels breaking ice, may disturb adult fish so that under-ice movement is increased and wintering areas are changed. Little research has been done regarding effects of vessel passage on fish movement in winter. It could produce additional stress at a critical time of year.

4. Wildlife

a. Without the Project

The land that borders Green Bay Harbor from the mouth of the Fox River upstream to the terminus of the Federal project is extensively urbanized. As a result, habitat for terrestrial wildlife has been greatly reduced. There are limited marshy areas beside the river where muskrats, eastern cottontails, ring-necked pheasants and small mammals live. The area at the mouth of the Fox River receives intensive bird use, especially during spring and fall migrations and in winter. From late autumn through ice-out in spring, the mouth of the Fox River is an area of open water because of the Pulliam Generating Station's thermal discharge. The open water is used by gulls and waterfowl, including about 450 giant Canada geese, 100 common mergansers, 50 common goldeneye, 150 herring gulls and other water birds. It is a hunting area for snowy owls who prey on sick and crippled waterfowl. Glaucous gulls, rare winter visitors from the north, are occasionally seen here. The only photographic confirmation of Arctic terns occurring in Wisconsin was obtained by a local ornithologist at the mouth of the Fox River.

Any program to keep Green Bay Harbor open for winter shipping would require that ice be broken for many miles beginning at the mouth of the Fox River and probably extending north of Sturgeon Bay, 40 miles to the north. Waterbird resources in the vicinity of the mouth of the Fox River are of state and, in

some cases, national importance. For these reasons, i.e., the necessity of applying ice management measures well beyond the harbor itself and the presence of state and nationally significant avian resources, we include the following description of bird life in lower Green Bay beyond the limits of the Federal harbor.

The area of Green Bay bounded on the north by Long Tail Point (west side) and Au Sauble (east side) is within about seven miles of the mouth of the Fox River and no more than about two miles from the Federal channel. The ice in this channel would have to be broken for winter shipping. Within this area of lower Green Bay are summer colonies of double-crested cormorants, cattle egrets, green herons, black-crowned night herons, least bitterns, herring gulls, ring-billed gulls, common terns, Forster's terns, and black terns. There is considerable nesting by waterfowl, including Canada geese, mallards, black ducks, pintail, gadwall, blue-winged teal, green-winged teal, wood ducks, redheads, and ruddy ducks. Other marsh birds nesting in the area include pied-billed grebes, American kestrel, Virginia rail, sora rail, common gallinule, American coot, killdeer, spotted sandpiper, common snipe, yellow-headed blackbird, and other more common songbirds and raptors.

Thousands of waterfowl, mostly diving ducks, stop in this area of lower Green Bay on their spring and fall migrations. Hundreds of whistling swans also stop

here, especially in spring, and people come from considerable distances in Wisconsin to view them. This is also an area of concentration for migrating raptors and shorebirds. Lower Green Bay is one of the richest areas of bird life in North America.

b. With the Project

Mechanical destruction of benthos, fish eggs, and newly hatched fish by ship propeller wash and ship wakes would reduce the food supply for those wildlife species that feed on benthos or fish, or are secondarily dependent on them. Almost all the colonial nesters, waterfowl, marsh birds, and other birds discussed feed on fish and/or benthos. Migrating and wintering diving ducks could have this food supply reduced. Waterfowl from widespread nesting areas congregate in open water and feed on small fish and benthos. If this food supply is depleted, they may not be able to leave or, if they do, they may be unable to find another protected area with food available at suitable water depths. The nutritional state of migrating waterfowl in fall and early winter is very important. Reproductive success may depend greatly on birds having adequate food in the pre-reproductive period of spring migration. If the food supply of these harbors is reduced by winter shipping, waterfowl reproductive success might be affected.

The impact of reduced benthos and fish life is not limited to waterfowl. The cormorants, gulls, mergan-

sers, grebes, and terns absolutely require fish. The food supply is essential for the presence of these water birds in lower Green Bay. Their habitat would be degraded by the direct loss of fish and benthic organisms on which many of the fish feed.

The potential for elimination of the benthos and fish from large parts of lower Green Bay--or beyond--seems greater from discharges and spills than from the mechanical impact of ship passages. The impact would depend on the timing, substance, weather, clean-up effectiveness, and other factors. Spills and discharges are harmful to wildlife in a number of ways. Many spilled and discharged substances are actually toxic or otherwise harmful to wildlife. The substances are ingested with contaminated food and water. This would be the case where ducks ate contaminated invertebrates, where snowy owls preyed on oiled birds and where shorebirds fed along contaminated shores. Birds in the water at the site of petroleum spills lose both insulation and buoyancy and, unless very lightly oiled, almost always die from hypothermia, drowning, or poisoning. Even with the best available human intervention, a very low percentage of oiled birds survive.

Winter complicates clean-up efforts and a spill in or near Green Bay Harbor would be expected to contaminate the shoreline. Oil on the water or on shore can affect bird populations. Recent research indicates that even small amounts of oil from a nesting bird's plumage can kill the embryos in eggs. Thus, even if the oil is not fatal to the individual bird, it could reduce that bird's reproductive success.

Waterfowl congregate in areas of open water where there is protection from wind and waves. At the same time, winter is a period of great stress due to scarce food supplies and increased energy requirements for body maintenance. Further stresses may result from the crowding of the flock and the unavailability of desirable habitat. Additional expenditures of energy that have no return value will be required as birds flee oncoming ships. There will be additional forced movement to harbor and water areas where conditions are less favorable.

Whether this anticipated degradation of the harbor environment for birds will be directly or indirectly harmful is not known. It is certain, however, that additional stress will have an adverse effect. The potential for inflicting catastrophic destruction in an area of statewide and national importance will be greatly increased should winter shipping be allowed at Green Bay.

5. Discussion

A winter bird study in the harbor could show where most use occurs and by which species. The same information could be determined for the fish biota. It may be possible to channel winter shipping to a less sensitive area of the harbor. Studies should be performed to ascertain the nature, magnitude, and temporal aspects of the fish life, including spawning use and food utilization in and near the harbor. Additional studies should be performed to describe the benthic community and its nature throughout the year.

Information describing the chemical and physical composition of the harbor bottom should be collected. Combined with information on the physical impacts of ship movement, the above information would provide the basis for a rational quantitative assessment of winter shipping. Measures to reduce or eliminate significant adverse impacts could then be investigated and developed.

6. Recommendations

The following recommendations supplement those listed previously for the Great Lakes Basin, Part F.

(1) Develop and conduct a study to reveal the nature, magnitude, spatial, and temporal aspects of avian and aquatic life in and around the harbor and lower Green Bay.

(2) Develop a comprehensive spill response plan that includes the training of local personnel, the stockpiling of spill and bird clean-up supplies and wildlife scaring devices; and the identification and securing of suitable space and food sources for cleaning and rehabilitating contaminated birds.

C. Calumet Harbor, IL and IN

1. Description of Area

Calumet Harbor, Calumet River and Lake Calumet Harbor are located on the southwest shore of Lake Michigan, within the corporate limits of the City of Chicago. The exception is a part of the Calumet Harbor breakwaters and anchorage area which is in Indiana.

The Calumet River was originally formed by the junction of the Little Calumet and Grand Calumet Rivers and flowed northeasterly into Lake Michigan, a distance of about 7-1/2 miles. In 1922, with the completion of the Calumet-Sag Channel as a sanitation and drainage canal, the natural flow of the river was reversed. Water that normally drained into Lake Michigan and the Great Lakes-St. Lawrence system was now diverted, by means of the Calumet-Sag Channel, to flow westerly into the Mississippi River system.

Lake Calumet, with a lake bed of some 2,200 acres, is in the process of being transformed from a natural to a man-made area. Extensive wetlands amounting to more than 1,000 acres existed at one time. The Chicago Regional Port District, which was created by the Illinois State Legislature in 1951, has jurisdiction over Lake Calumet. The Port District is required by law to retain control of at least 500 acres of the lake bed. The north half of the lake will be commercial and industrial fill sites. The south end of the lake will be developed as a harbor. Most of the lake and adjoining lands are to be developed.

This area is Chicago's future industrial and manufacturing center with numerous rail and barge facilities. Heavy industry (foundries, steel production, automobile plants, ship building, etc.) and power generating plants will occupy most of the shoreline. Some wetlands still remain but are in extreme danger from the described developments.

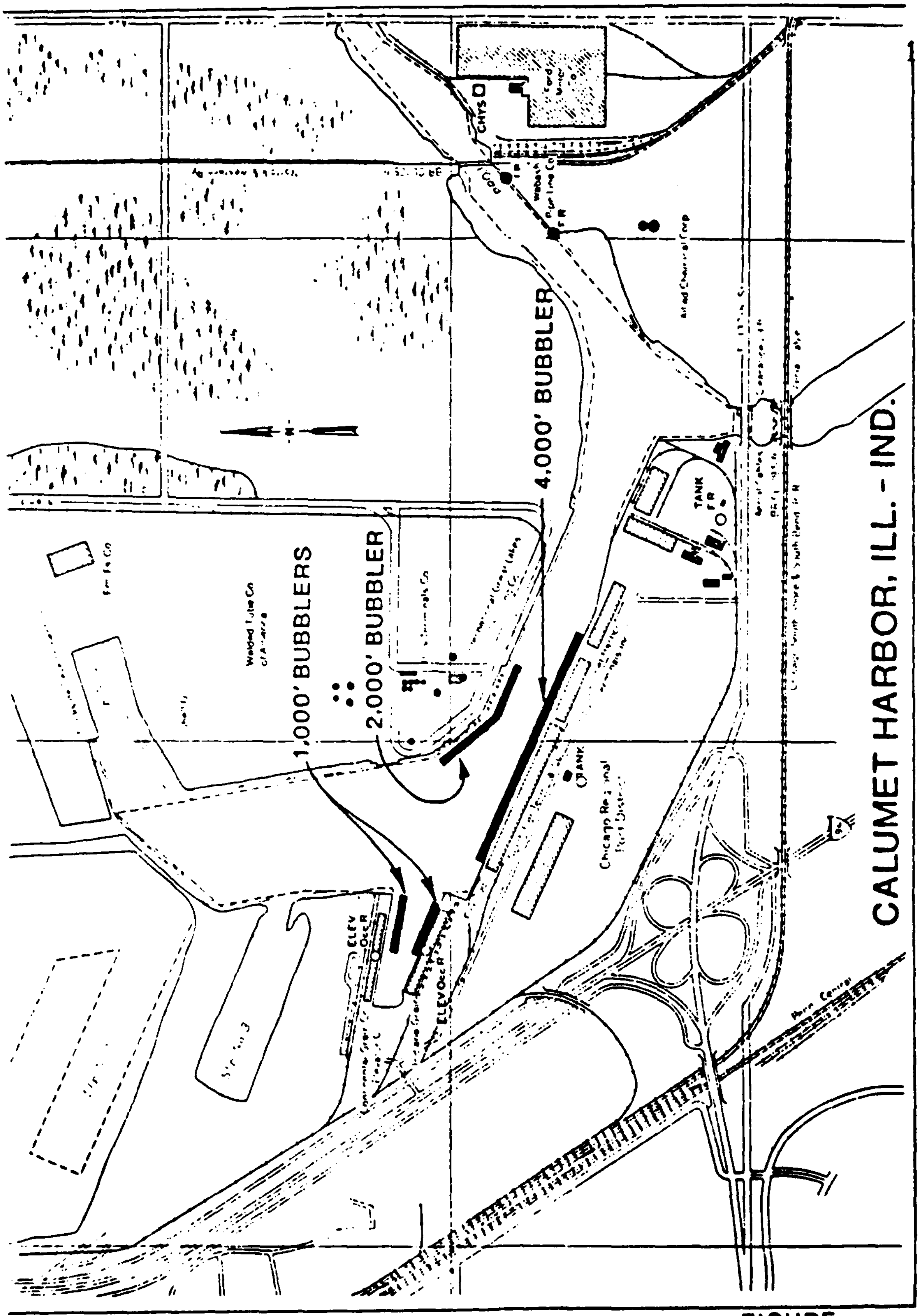
2. Description of Project

The plan includes several bubbler systems in addition to ice breaking in the harbor. See Figure V-C-2-1. Bubbler systems are to be located in three areas adjacent to Lake Calumet. Two 1,000-foot systems would be installed at slip number 1 (Continental Grain-Indiana Co-op docks), a 2,000-foot system along International Great Lakes Shipping Company facilities and a 4,000-foot system adjacent to the Chicago Regional Port District transit sheds.

3. Fish

a. Without the Project

Fish surveys for Lake Calumet were completed in 1952, 1970 and 1976. The 1952 and 1970 collections revealed a fish population dominated by carp but consisting of largemouth bass, bluegill, green sunfish, yellow perch, carp, goldfish, gizzard shad, fathead minnows, bluntnose minnows, and alewifes. The earlier survey also included northern pike and grass pickerel. The Metropolitan Sanitary District of Greater Chicago sampled the Cal-Sag Channel, Little Calumet River and Calumet River during 1976. Carp, goldfish and bluntnose minnows comprised 90 percent of the total catch at mile 327.0 (turning basin number 5). Largemouth bass, yellow perch, green sunfish, pumpkinseed and black crappie (7.5 percent of total catch) were the only game species collected. A possible fish spawning area was reported near the O'Brien Lock (mile 327.0).


CALUMET HARBOR, ILL. - IND.
1,000' BUBBLERS
2,000' BUBBLER
4,000' BUBBLER
TANK
ELEV

FIGURE

V-C-2-1

The area is a shallow wetland suitable for sunfish spawning and sunfish nests have been observed in this area. Due to the nature of the area and the species of fish present, fishing pressure is almost nonexistent. There are no fishery management programs in Calumet Harbor.

b. With the Project

Installation of 7,000 feet of bubbler pipe should have little significant effect. Preventing ice formation along presently used industrial docks should not further degrade the fishery. Increased dissolved oxygen levels might improve conditions for game fish but high pollutant levels will continue to be the determining factor. Any resuspension of bottom sediments caused by bubbler systems, icebreaking, or ship passage will increase turbidity and decrease water quality. Sediments in Calumet Harbor and River have been classified as heavily polluted by the U. S. Environmental Protection Agency.

4. Wildlife

a. Without the Project

The natural terrestrial environment has been replaced by industrial development in this area. Except for urban species, including song birds and squirrels, the prime wildlife is waterfowl.

b. With the Project

Installation of three bubbler systems in the Lake Calumet area should have little effect on wildlife resources. The amount of open water which may occur because of the bubbler is small compared to the open water already present due to warm water effluents.

5. Discussion

Bubbler systems installed at presently used docks should have little effect on fish and wildlife resources in the Calumet Harbor area. Water and sediment pollutant levels in Calumet River and Harbor are such that a viable sport fishery is almost impossible. Seven thousand feet of bubbler system will not affect present conditions.

6. Recommendations

The following recommendations supplement those listed previously for the Great Lakes Basin, Part F.

(1) Vessel speeds be restricted as much as possible to minimize resuspension of polluted sediments.

(2) Study the effects of resuspended polluted material on water quality and fish and wildlife resources.

D. Indiana Harbor, IN

1. Description of Area

Indiana Harbor lies in the eastern half of the Calumet Region at the southern end of Lake Michigan. One-third of the region is in Illinois and two-thirds in Indiana. The Indiana shorelands and dunes in this region extend from about Michigan City, Indiana, to the Illinois-Indiana State line, a distance of 41 miles. About 13.5 miles of shorelands along this reach are included in the authorized Indiana Dunes National Lakeshore, including 3 miles of Indiana Dunes State Park. The Calumet Region is one of the major industrial regions of the United States. The industrial complex in this region includes some 200 industries manufacturing over 1,000 products. The primary industry in the region is manufacturing, with the most notable being steel and its associated by-products.

2. Description of Project

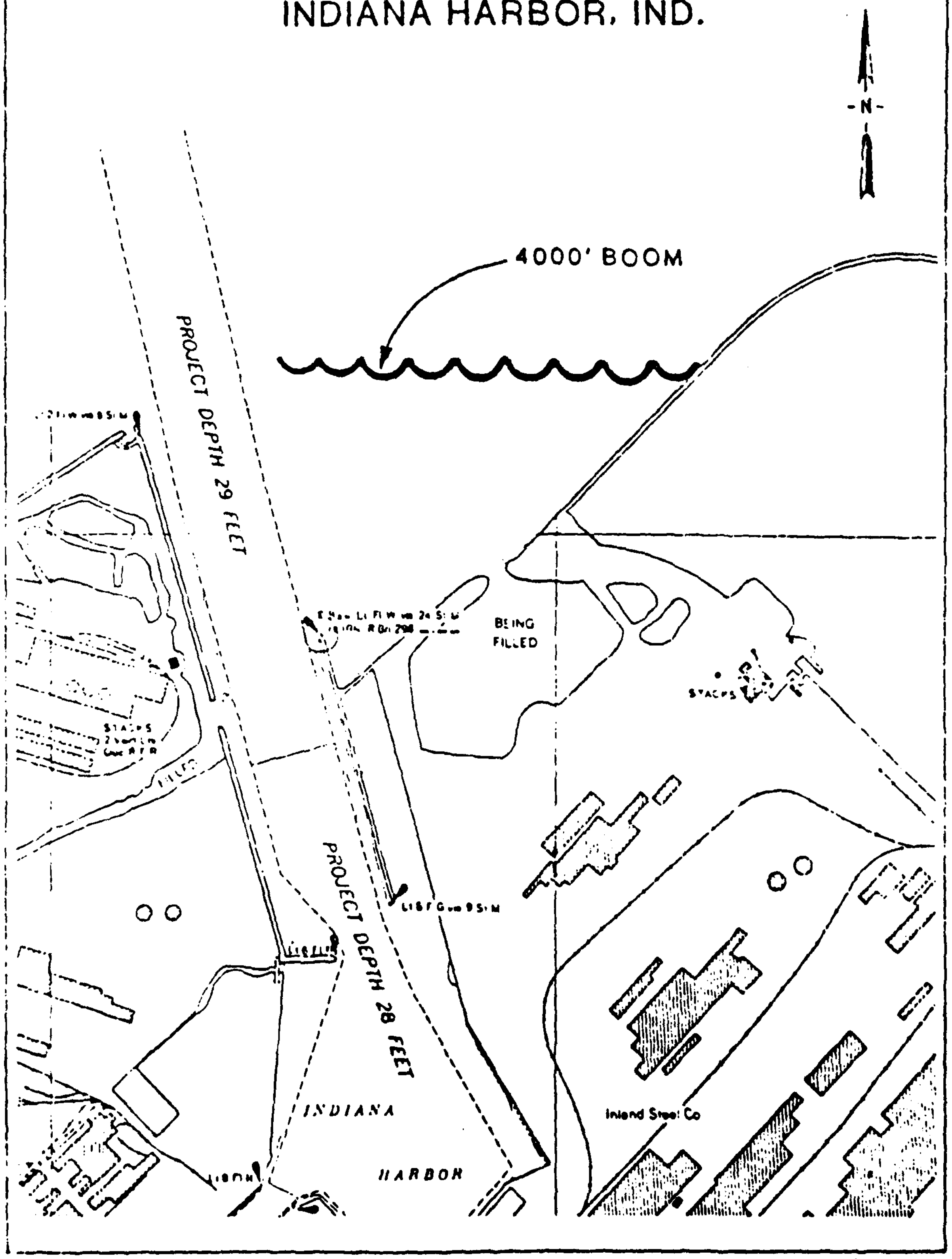
The plan of development calls for ice breaking to the harbor. A 4,000-foot ice boom has been proposed for the entrance to Indiana Harbor. The boom would run lakeward along the channel from Inland Steel's contained disposal area. See Figure V-D-1.

3. Fish

a. Without the Project

A large variety of fish spend at least part of their life cycle in the shallower inshore waters of Lake

INDIANA HARBOR, IND.



FIGURE

V-D-1

Michigan. Some species, such as yellow perch and members of the catfish family, spend most of their life in shallow water; other species, such as salmonids may be present in the shallows only when immature or during migrations. The species of recreational and economic importance include the yellow perch, alewife, walleye, carp, drum, white bass, bullhead, and members of the salmon family. Salmonids present include the rainbow trout, brook trout, chinook salmon, coho salmon and lake trout.

Discussions with Indiana Department of Natural Resources fisheries personnel in Michigan City, Indiana, indicate that there is no significant sport or commercial fishery in Indiana Harbor. Only rough fish species exist in the harbor and canal. Outside the harbor in the vicinity of the Inland Steel Company lakefill, Lake Michigan supports a large, mainly recreational, fishery during spring and fall salmonid migrations.

In 1973, the Indiana Department of Natural Resources (IDNR) began stocking brown trout in the Jeorse Park area, located southeast of the Inland Steel Company lake fill area. Stocking of lake trout and chinook salmon was started in this area in 1974 and 1977, respectively. Spawning has not been successful due to lack of suitable substrate.

b. With the Project

Future modifications to Indiana Harbor probably would not result in significant effects on the existing fishery.

4. Wildlife

a. Without the Project

Almost all of the shorelands in the Indiana Harbor area have been substantially modified and consist of artificial lakefills. These shorelands are highly industrialized. The natural terrestrial environment has been replaced by industrial and urban development. Except for urban species, the prime wildlife is waterfowl. The lands and waters in the Indiana Harbor area do not have unique ecological or natural areas.

b. With the Project

Waterfowl and other wildlife within Indiana Harbor should not be affected by this project.

5. Discussion

Installation of a boom to prevent ice blockages in Indiana Harbor should have no effect on fish and wildlife resources. Heavy industrial use of this area precludes the establishment of a viable fishery. Spring and fall runs of salmonids occur in this area but will not be affected.

E. Muskegon, MI

1. Description of Area

The largest port on the eastern shore of Lake Michigan, Muskegon Harbor in Muskegon County, Michigan, stands among the most progressive and active of Great Lakes harbors. As a handler of many diversified goods, including foreign cargo, Muskegon has become western Michigan's gateway to the trade centers of the world. Coal, limestone, petroleum products, building cement and auto parts are among the cargoes handled.

Muskegon Lake, which forms the harbor basin, has a length of five miles and a width of one to two miles. The entrance channel from Lake Michigan is protected by breakwaters forming an outer basin and piers which continue along the inner channel banks as revetments. Channel depth is 27 feet with a width of 200 feet.

Waterborne commerce averaged about 3,073,000 tons annually from 1970 to 1974. In 1974, 2,508,000 tons passed through the harbor.

Public docking facilities for recreational craft are available at the Hartshorn Municipal Marina, jointly constructed by the city and the Michigan Waterways Commission. A Coast Guard station is located on the south side at the harbor entrance.

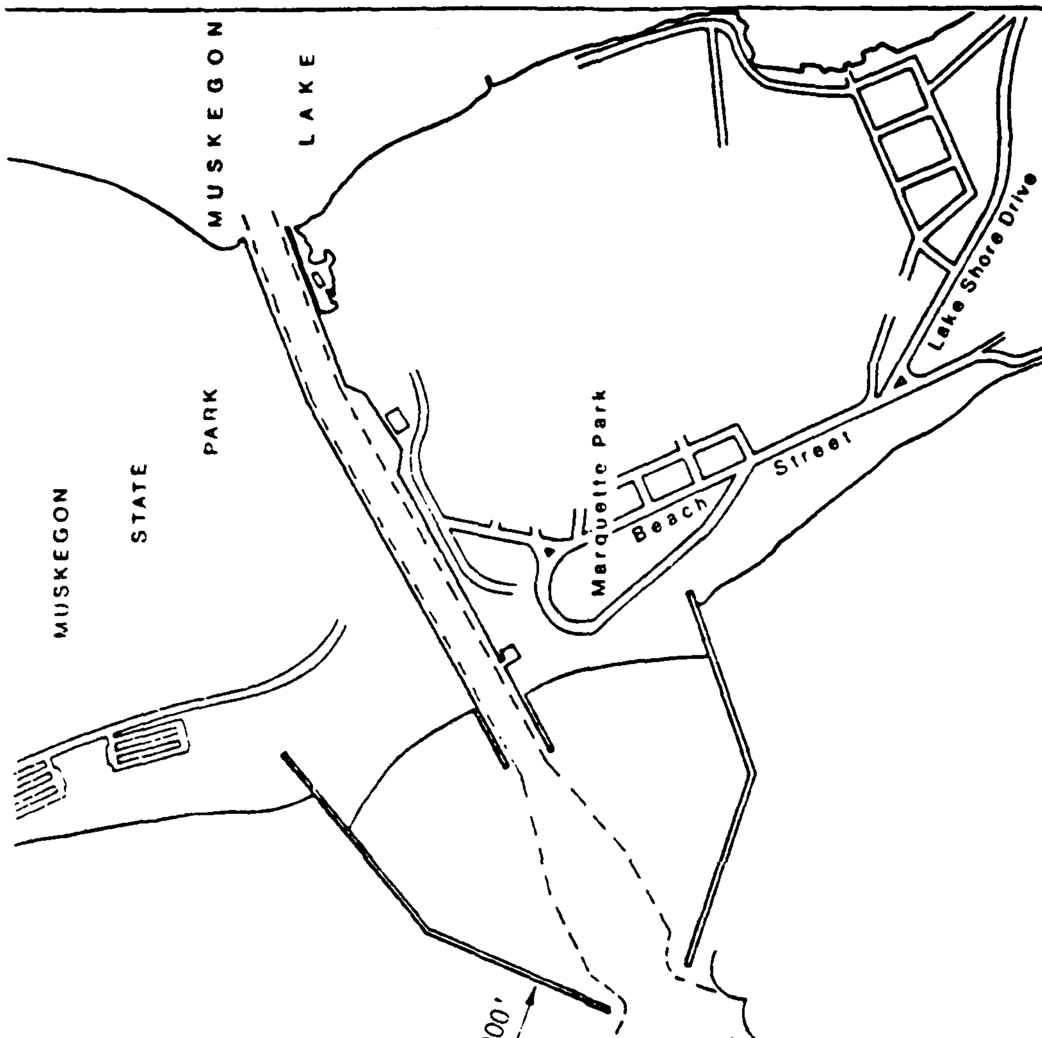
Numerous yacht clubs, parks and public camps are located in the immediate vicinity of the harbor. Muskegon State Park and Pere Marquette Park, adjacent to the north and south sides of the harbor, respectively, attract many people throughout the year. The area is popular for camping, boating and fishing.

The U. S. Environmental Protection Agency has classified the sediments of Muskegon Lake and harbor as non-polluted.

2. Description of Project

The general navigation season usually ends in late December and resumes in March. Car ferries currently operate year-round between Muskegon and Milwaukee. Most ice problems are not in the harbor but at the harbor entrance and out into Lake Michigan. Ice does not prevent winter shipping but does cause delays until the winds shift and/or lessen in intensity. Windrows of pack ice up to 12 feet thick have blocked the harbor entrance and prevented ships, including icebreaking vessels, from entering or leaving the harbor. These conditions are dependent on wind conditions which usually change within 8 hours, but may last as long as 6 days. The ice in Lake Muskegon is generally solid, uniform and less than 24 inches thick. The car ferries and barges presently keep a navigation track open and experience little difficulty in the harbor.

Proposed improvements for Muskegon harbor are two ice booms totaling 7,600 feet and an icebreaking tug. (See Figure V-E-2-1). The westerly boom extends 4,800 feet and is



MUSKEGON HARBOR
ICE BOOM LOCATIONS

FIGURE V-E-2-1

located approximately 1,000 feet lakeward of the north breakwater. The easterly boom extends 2,800 feet southwest from the end of the south breakwater. The icebreaker would operate as needed at the harbor entrance or on Muskegon Lake.

3. Fish

a. Without the Project

Fishes of the Muskegon harbor area represent the Muskegon River, Muskegon Lake and Lake Michigan, three very different aquatic habitat types. As a result, a variety of species occur, some of which are permanent residents, while others are seasonal or migratory. Yellow perch, walleye, largemouth and smallmouth bass, northern pike, rock bass, bluegill, black crappie and white sucker are commonly found in Muskegon Lake all year. Rainbow and brown trout and coho and chinook salmon enter Muskegon Lake and ascend the Muskegon River on spawning runs in spring and fall. Rainbow smelt and alewifes are abundant in Muskegon Lake in spring and summer, respectively.

In spring, northern pike and yellow perch spawn successfully in wetlands along the northeast corner of Muskegon Lake and in the lower Muskegon River. Salmonids also spawn successfully farther upstream. Lake

trout and lake whitefish spawn in Lake Michigan waters adjacent to Muskegon in fall. Lake trout, however, are not spawning successfully. The presence of lake whitefish spawning and nursery areas is suspected but the areas have not been conclusively located.

The benthic community consists of oligochaete worms of the families Lumbriculidae and Tubificidae and insect larvae of the dipteran family Chironomidae (midges). Freshwater clams, snails and mayfly larvae, important fish food items, are also found in this area.

Sport fishing is popular throughout the year, with coho and chinook salmon and rainbow and lake trout included in the catch. Northern pike, yellow perch, bluegill and black crappie are the most common species caught in winter. The Michigan Department of Natural Resources (MDNR) estimates that 1,495 ice fishermen in 10,235 angler-days caught 38,295 fish during the winter of 1976 from Muskegon Lake. Yellow perch comprised 60 percent of the catch.

Commercial fishing on Muskegon Lake is currently permitted by MDNR for assessment purposes only.

The longjaw cisco, (Coregonus alpenae) a Federally listed endangered species, once may have been found in the deep waters of Lake Michigan off Muskegon.

b. With the Project

We do not believe that ice booms proposed for protecting the entrance to Muskegon Harbor would significantly effect the fishery of Muskegon Lake or adjacent waters of Lake Michigan.

Historically, winter ferry traffic may have changed ice-fishing sites. Additional traffic and icebreaking could eliminate the use of some present ice fishing sites and could disrupt present fish wintering habitats and fish movement. Bottom sediments may be stirred up and reduce benthic populations and fish food productivity. Muskegon Lake is not believed to be an important spawning or nursery area for fall-spawning fish, whose eggs and larvae would be vulnerable to increased disturbance of bottom sediments.

4. Wildlife

a. Without the Project

The land around Muskegon is a composite of beaches, marshlands and upland forests. This diversity of habitat provides for many wildlife species. Mammals occurring in the area include whitetail deer, black bear, coyote, gray and red fox, striped skunk, porcupine, eastern cottontail, snowshoe hare, gray fox and red squirrel, raccoon, mink, river otter, beaver and muskrat. Birds include marsh and shore birds, waterfowl, raptors, and songbirds. Woodcock and ruffed

grouse are found in upland areas. Twenty-one species of reptiles and 18 species of amphibians may be found in the Muskegon area. Because of the urban nature in the immediate area of Muskegon Lake, only birds and other urban wildlife species are present.

The shallow waters and shoreline marshes are important nesting, resting and feeding areas for shore and marsh birds as well as waterfowl. Diving ducks, geese and swans use the deeper open waters during migration. Mink and muskrats, valuable furbearers, are locally abundant in coastal wetlands and river deltas. Beaver and river otter are common along rivers farther upstream.

Wintering waterfowl are confined to small open areas inside the harbor and at the Consumers Power Company generating plant on the eastern end of Muskegon Lake. Species commonly observed in winter include canvasback, bufflehead, common goldeneye, common merganser, black duck, mallard, coot, herring gull and ring-billed gull.

The Muskegon area provides very important habitat for migrating waterfowl, passerines, raptors and shore birds.

Waterfowl hunting and trapping are popular fall activities in the Muskegon area. No estimates of the harvest are available. Bird watching, wildlife photography and nature study are also popular.

Federal endangered species which may be seen on occasion around Muskegon are the peregrine falcon and Kirtland's warbler. The bald eagle, recently reclassified to threatened status in Michigan, may also be observed.

b. With the Project

The proposed project should not significantly alter the wildlife species composition of the Muskegon area. Icebreaking and additional vessel traffic would result in additional open water attractive to waterfowl. If more birds stay than feeding areas can support, mortality due to malnutrition would result. An oil spill in winter could produce high mortality because of the high density of birds in a confined area. Icebreaking and additional ship traffic could degrade habitat for benthic organisms causing long-term adverse effects.

5. Discussion

Effects of ice booms and icebreaking tugs in Muskegon Harbor and Muskegon Lake include the following:

(1) Disturbance of adult fish and their habitats, particularly yellow perch and northern pike, by vessel traffic.

(2) Interruption of sport fishing by additional icebreaking.

(3) Creation of additional open water areas.

(4) Disruption of benthic communities due to additional vessel traffic and icebreaking.

Vessel movement, particularly vessels breaking ice, may disturb adult fish so that their movement under ice is increased and wintering habitats are changed. These impacts in the Muskegon area could affect sport fishing areas and catch. Little research has been done regarding vessel passage on fish movement in winter.

The adverse effects of icebreaking and vessel movement in Muskegon Lake could be reduced by strict enforcement of reduced vessel speed in Muskegon Lake.

Sport fishermen maintain what they feel is a safe distance from the ship track and are reluctant to cross it until shipping ceases. Additional broken ice tracks to docks proposed for winter traffic would place additional restrictions on where ice fishing could occur and pose possible safety problems for ice fishermen.

Waterfowl can be induced to winter in an area by providing open water. Icebreaking and ice booms would result in more open water in Muskegon Harbor. If more waterfowl stay in an area than the food supply can support, malnutrition would cause mortality and increase susceptibility to parasites and disease.

6. Recommendations

The following recommendations supplement those listed previously for the Great Lakes Basin, Part F.

(1) Confine winter ship traffic to those parts of the harbor and Muskegon Lake where studies indicate the least adverse impacts will result. This determination should be made in consultation with the Michigan Department of Natural Resources, Environmental Protection Agency, and U. S. Fish and Wildlife Service.

(2) Establish and enforce reduced vessel speed limits in Muskegon Lake.

F. Ludington, MI

1. Description of Area

Ludington Harbor is located in Mason County, Michigan, on the east shore of Lake Michigan approximately 153 miles northeast of Chicago, Illinois, and about 60 miles north of Muskegon, Michigan. The inner harbor is situated in Pere Marquette Lake which is separated from Lake Michigan by a narrow strip of land - the Buttersville bar. The Pere Marquette River, with headwaters about 50 miles inland, flows westerly and discharges into the south end of Pere Marquette Lake. Existing commercial navigation dockage facilities located along the eastern shore of Pere Marquette Lake include those of the Dow Chemical Company and the Chesapeake and Ohio rail and passenger car ferry operations.

Ludington Harbor is currently undergoing the following modifications:

a. Removal of 100 feet of the outer end of the south breakwater to provide a harbor entrance through the outer breakwaters about 545 feet wide.

b. Removal of the south inner pier and sheet pile revetment along the south side of the inner channel.

c. Dredging a channel to a depth of 30.0 feet below LWD from deep water of Lake Michigan to a line 800 feet within the outer breakwater over a minimum width of 600 feet; thence east at a depth of 20.5 feet to a line opposite the west end of the proposed south wave absorber; thence east at a depth of 29.0 feet over a minimum width of 230 feet to deep water in Pere Marquette Lake; widening of the turn into Pere Marquette Lake.

d. Construction of a 900-foot long rubblemound wave absorber along the south face of the north inner pier and sheet pile revetment.

e. Construction of a 500-foot long rubblemound wave absorber on the south side of the inner channel and a 650-foot long steel sheet pile revetment along the south side of the widened turn into Pere Marquette Lake.

f. Construction from salvaged stone and broken concrete of a 600-foot long rubblemound breakwater in front of a city and state owned boat launching ramp in the harbor basin on the north side of the channel.

The harbor is used for commercial, recreational, and refuge purposes. Waterborne commerce is approximately 4,000,000 tons annually with roughly three quarters of this being car ferry traffic to and from the Chesapeake and Ohio Railroad docks. In 1973, auto-train ferry operations varied between six and nine arrivals and departures per day. Most of the balance of commerce consists of limestone receipts by the Dow Chemical Company. Dow also handles approximately 150,000 tons of fuel oil receipts annually and ships a similar amount of chemicals. Limestone is moved by self-unloading bulk-carriers and fuel oil by tankers. Occasionally tugs, tow boats, barges, and commercial fishing boats also use the harbor.

Recreational uses of the harbor include fishing, boating, and sightseeing. The breakwaters provide access to recently established perch fishing areas and scenic approaches to Lake Michigan. The existing harbor boat launching area and the proposed public marina at the north end of Pere Marquette Lake enhance present and future recreational opportunities.

Pere Marquette Lake is oriented in a north-south direction parallel to the Lake Michigan shoreline. The lake is about two miles long and has an average width of about one-half

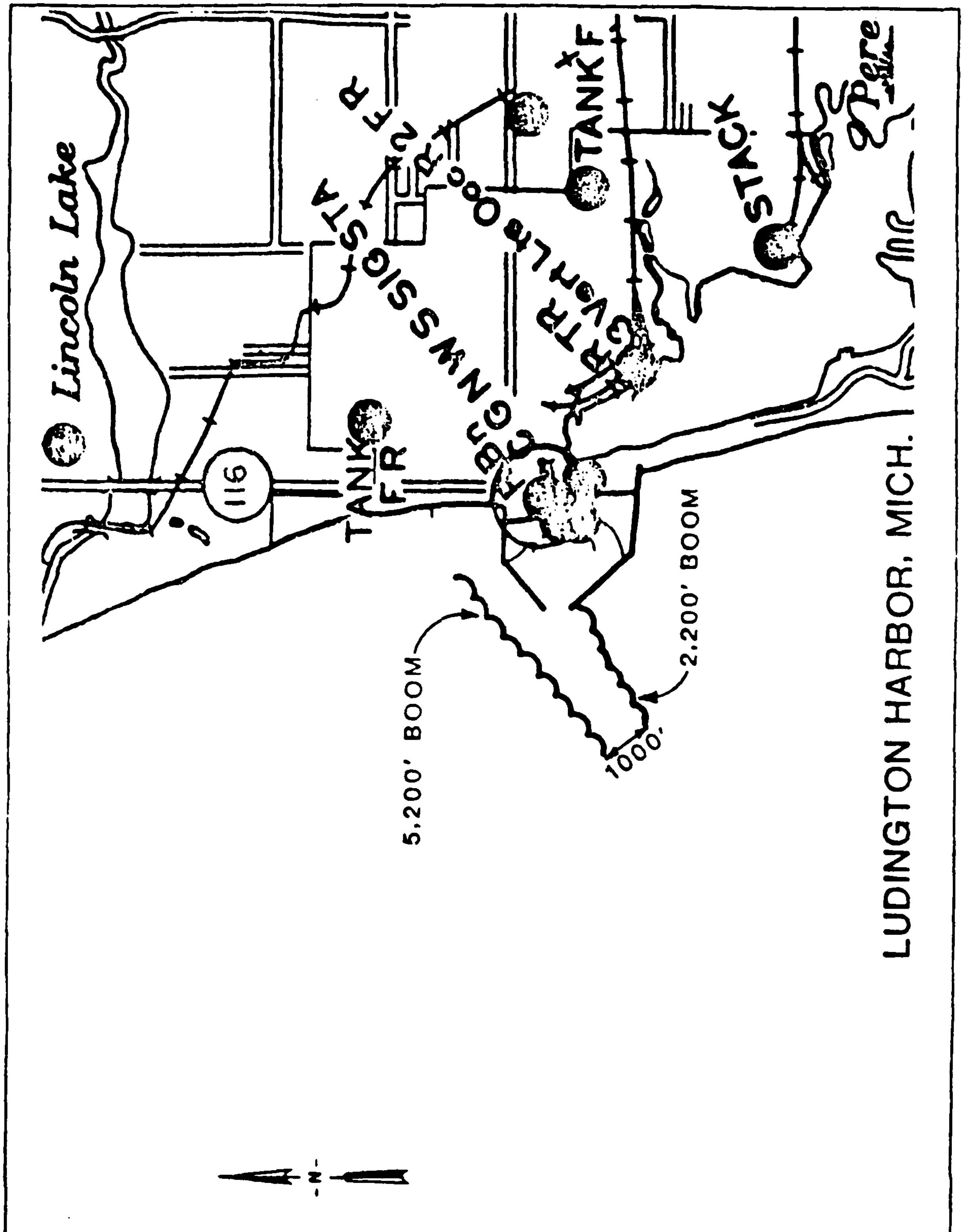
mile. It has a maximum natural depth of 44 feet and a considerable area greater than 27 feet deep. Approximately 600 acres of wetlands border the southern and southeastern ends of the lake.

The Pere Marquette River flows into the southeast end of Pere Marquette Lake. The river is greatly valued for its recreation aspects including canoeing, swimming, and fishing. The U.S. Forest Service and the State of Michigan have requested Congress to declare the river a "scenic" river - a measure that would provide for maintaining the quality of the river for scenic enjoyment.

No published or other readily available information exists on the harbor water quality. Nutrients and organic material loadings in the harbor come from several sources: the Pere Marquette River Watershed, the City of Ludington Sewage Treatment Plant and industrial wastes. Pere Marquette River water is similar to that of Lake Michigan in major dissolved solids content. Lake Michigan water is of low hardness and has a total dissolved solids content of less than 250 parts per million.

2. Description of Project

Proposed improvements for Ludington Harbor are two ice booms totaling 7,400 feet and an icebreaking tug. (See Figure V-F-2-1). The north boom will be approximately 1,000 feet north of and parallel to the north breakwater. It will extend from northeast to southwest approximately 5,200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V-F-2-1

FIGURE

feet. The south ice boom will extend southwest from the end of the south breakwater for approximately 2,200 feet. It will be parallel to the north boom and maintain a channel to the harbor entrance 1,000 feet wide. An icebreaking tug will also be needed, but Ludington is not planned as a home port and no additional mooring facilities are needed.

Ludington, Michigan, is open to shipping all year with the Chesapeake and Ohio Railway Car Ferry operating out of the harbor. Three slips accommodate the commercial ferries which have traffic entering and exiting the harbor on a daily basis. This helps to prevent a solid ice buildup from the harbor entrance to the ferry dock.

3. Fish

a. Without the Project

Fishes of the Ludington area reflect the three habitat types which come together in the harbor--Pere Marquette River, Pere Marquette Lake, and Lake Michigan. Yellow perch, walleye, largemouth and smallmouth bass, northern pike, rock bass, black crappie, white sucker, and lake sturgeon are commonly found in Pere Marquette Lake during all seasons. Rainbow and brown trout and coho and chinook salmon enter Pere Marquette Lake and ascend the Pere Marquette River on spawning runs in spring and fall. Rainbow smelt and alewife are seasonally abundant in Pere Marquette Lake.

Northern pike and yellow perch spawn successfully in the wetlands along the southeast corner of Pere Marquette Lake and along the lower Pere Marquette River. Another yellow perch spawning area exists immediately south of the south breakwater.

The trout and salmon all spawn successfully in the Pere Marquette River. Brown trout have been stocked in the river to supplement natural reproduction. Atlantic salmon have also been stocked by the Michigan Department of Natural Resources (MDNR). MDNR personnel tallied over 8,000 mature chinook salmon in the fall of 1977 at a weir on the Pere Marquette River.

Collections of bottom fauna have been made at irregular intervals by the Dow Chemical Company as well as joint surveys by the MDNR and the Michigan Department of Public Health (MDPH). Collecting areas have included the outer harbor, inner channel, Pere Marquette Lake, the river to the Highway M-31 bridge and the mouth of the Pere Marquette River.

Collections revealed high populations of a variety of benthic organisms. The least productive stations, though still exhibiting populations approaching 2,000 individuals per square meter, were in the inner and outer channels. Turbulence and bottom instability due to ship traffic are probable causes. The characteristic benthos were aquatic earthworms, scuds, and midges. The high populations suggest that the shallow sediments of the outer harbor are enriched in nutrient matter.

The Dow collection included specimens from depths ranging from three feet to 42 feet. Aquatic earthworms and red midges were the most widely distributed organisms found. Other collected organisms included green midges, snails, clams, mayflies and scuds. The diversity of organisms is typical of lakes that have muddy bottoms and rather uniform temperatures throughout the entire depth range. The assemblages indicate generally that the bottom and the lake water are not significantly polluted.

Ludington Harbor and Pere Marquette Lake are popular sport fishing locations throughout the year. In spring, brown trout are caught around the breakwaters and inside the harbor by shore, pier-breakwater, and trolling fishermen. Chinook salmon are taken in spring by fishermen trolling on Lake Michigan in up to 40 feet of water. The rainbow trout spawning run in the Pere Marquette River attracts anglers from around the region. Later in spring and in summer, fishermen catch yellow perch, walleyes, northern pike, largemouth and smallmouth bass, and black crappies in Pere Marquette Lake. In early fall charter boats work the Lake Michigan shoreline and Pere Marquette Lake for coho and chinook salmon.

Northern pike and yellow perch are popular species with ice fishermen. Popular ice fishing locations are the Ludington Yacht Club and Dow Chemical area along the east shore of Pere Marquette Lake, and near

the power plant and Albrecht's Marina on the west shore. The Michigan Department of Natural Resources estimated, from creel census information, an ice fishing harvest of 5,500 northern pike, 5,400 yellow perch, and 4,000 suckers from Pere Marquette Lake in 1976. Fishing effort was estimated at 12,765 angler days by 805 fishermen.

The only commercial fishing out of Ludington at present is two experimental MDNR contracts for lake whitefish and chub assessment.

The longjaw cisco (*Coregonus alpenae*), a Federal endangered species, may have once been found in the deep waters of Lake Michigan off Ludington.

b. With the Project

We do not believe that ice booms proposed for protecting the entrance to Ludington Harbor will have any effect on the fishery of Pere Marquette Lake or adjacent waters of Lake Michigan.

Winter ferry traffic may have changed ice fishing sites. Additional traffic and ice breaking could eliminate the use of present ice fishing sites and could disrupt present fish wintering areas and fish movement. Bottom sediments will be stirred up and reduce benthic populations and productivity. Pere Marquette Lake

is not believed to be an important spawning or nursery areas for fall-spawning fish, whose eggs and larvae would be vulnerable to increased disturbance of bottom sediments.

4. Wildlife

a. Without the Project

The land around Ludington and Pere Marquette Lake is a composite of beaches, marshlands and upland forests. This diversity of habitat provides for many wildlife species. Mammals occurring in the area include white-tail deer, black bear, coyote, gray and red fox, striped skunk, porcupine, eastern cottontail, snowshoe hare, gray, fox, and red squirrels, raccoon, mink, river otter, beaver and muskrat. Birds include marsh and shore birds, waterfowl, raptors, and songbirds. Woodcock and ruffed grouse are found in upland areas. Twenty-one species of reptiles and 18 species of amphibians may be found in and around Ludington.

The shallow waters and shoreline marshes are important nesting, resting, and feeding areas for shore and marsh birds as well as waterfowl. Diving ducks, geese, and swans use the deeper open waters during migration. Mink and muskrats, valuable furbearers, are locally abundant in coastal wetlands and river deltas. Beaver and river otter are common along rivers farther inland.

Winterirq waterfowl are confined to small open areas inside the harbor. Species commonly observed in winter include bufflehead, common goldeneye, common merganser, and herring gull. Snowy owls are seen occasionally perched along open water.

Large numbers of raptors and songbirds pass through the Ludington area during spring migration.

Waterfowl hunting and trapping are popular fall activities in the Ludington area. No estimates of waterfowl or furbearer harvest are available. Bird watching, wildlife photography, and nature study are also popular.

Two Federal endangered species may be seen on occasion around Ludington. They are the peregrine falcon and Kirtland's warbler. The bald eagle, recently reclassified to threatened status in Michigan may also be observed.

b. With the Project

The proposed project should not significantly alter the wildlife species composition of the Ludington area. Icebreaking and additional vessel traffic would result in additional open water attractive to waterfowl. If more birds are induced to stay than feeding areas can support, mortality due to malnutrition would result. An oil spill in winter could produce high mortality

because of the high density of birds in a confined area. Icebreaking and additional ship traffic could degrade habitat for benthic organisms causing long-term adverse effects.

5. Discussion

Effects of ice booms and icebreaking tugs in Ludington Harbor and Pere Marquette Lake which need to be addressed include the following:

a. Disturbance of adult fish, particularly yellow perch and northern pike, by vessel traffic.

b. Interruption of sport fishing by additional icebreaking.

c. Hazards of oil and toxic substance spills in winter.

d. Creation of additional open water areas.

e. Disruption of benthic communities due to additional vessel traffic and icebreaking.

Vessel movement, particularly vessels breaking ice, may disturb adult fish so that under ice movement is increased and wintering areas are changed. These impacts in the Ludington area could affect sport fishing areas and catch. Little research has been done regarding vessel passage on fish movement in winter.

Sport fishermen apparently maintain what they feel is a safe distance from the ship track and are reluctant to cross it until shipping ceases. Additional broken ice tracks to docks proposed for winter traffic would place additional restrictions on where ice fishing could occur and when access by ice to other areas would be safe.

Spills of oil, hazardous materials and toxic substances present special problems in winter. It can be difficult or impossible to get cleanup equipment to the spill and operate it. Low temperature causes some oil to congeal and sink to the bottom where it can smother benthic organisms. Waterfowl are concentrated in limited open water areas and are particularly vulnerable.

Waterfowl can be induced to winter in an area by providing open water and food. Icebreaking and ice booms would result in more open water in Ludington Harbor. If more waterfowl stay in an area than the food supply can support, malnutrition would cause mortality and increase susceptibility to either stresses such as parasites and disease. Additional open water could also provide additional areas for humans to view wintering waterfowl.

6. Recommendations

The following recommendation supplements those listed previously for the Great Lakes Basin, Part F.

(1) Confine winter ship traffic to those parts of the harbor and Pere Marquette Lake where studies indicate the least adverse impacts will result. This determination should be made in consultation with the Michigan Department of Natural Resources, Environmental Protection Agency and U. S. Fish and Wildlife Service.

G. Sturgeon Bay, WI

1. Description of Area

The Sturgeon Bay and Lake Michgian Ship Canal, Door County, Wisconsin, was authorized by the River and Harbor Act of 1873 and modified by subsequent acts. It consists of an outer basin formed by two breakwaters extending into Lake Michigan, a revetted caral, an entrance channel 23 feet deep extending from Lake Michigan to 800 feet west of the east entrance canal, a channel 22 feet deep and 8.6 miles long through the revetted canal and Sturgeon Bay to Sherwood Point, and a turning basin 20 feet deep at the City of Sturgeon Bay.

Waters of the Sturgeon Bay Ship Canal generally meet Wisconsin standards for fish and aquatic life. Water movement through the channel results in higher suspended solids levels within the canal than in adjacent waters of Lake Michigan and Green Bay. Dissolved oxygen concentrations are at or near saturation most of the time with the exception of a few shallow, isolated areas.

Sediments in the ship canal are predominantly silt and classified as polluted by the U.S. Environmental Protection Agency, requiring confined disposal. The canal freezes over completely in winter.

Potawatomi State Park borders the southwest canal shore for three miles. Sunset Park, located across the canal near the north city limits of Sturgeon Bay, has 2,000 feet of shoreline frontage.

2. Description of Project

Additional mooring facilities for a Type C icebreaker are proposed for the Sturgeon Bay Ship Canal. Detailed location and design plans are not currently available. We assume that dredging would be required during construction and maintenance of such facilities.

3. Fish

a. Without the Project

Important fish species found in the Sturgeon Bay Ship Canal include lake whitefish; brook, brown, rainbow, and lake trout; coho and chinook salmon; northern pike, walleye, yellow perch and smallmouth bass. Rainbow smelt and alewife are abundant in spring and summer, respectively. Trout and salmon populations are maintained by continued stocking. Northern pike, yellow perch and smallmouth bass spawn successfully in the canal. The Wisconsin Department of Natural Resources (DNR)

has stocked millions of walleye fry and fingerlings in the waters of Green Bay for the past four years in an attempt to develop a sport fishery for that species. Sawyer Harbor on the western end of the ship canal has been an area of concentrated effort.

The City of Sturgeon Bay experienced a sport-fishing boom following the stocking of salmonid species in both Lake Michigan and Green Bay. Fishing occurs from breakwaters and shore for all the salmonids except lake trout during the entire ice-free period. Many private craft and commercial charter boats operate out of Sturgeon Bay trolling for trout and salmon. Thousands of anglers fish along the shores of the ship canal in the fall. Ice fishing for yellow perch and walleyes occurs all along the canal.

The Wisconsin DNR estimated 19,380 angler trips for the trolling fishery, 6,112 trips for the breakwater fishery and 8,961 trips for the shore fishery at Sturgeon Bay in 1976. The salmonid catch for each area was 6,618 - trolling, 2,373 - breakwater, and 3,471 - shore. Lake trout made up the majority of the trolling catch while chinook salmon were most abundant in the shore catch. Breakwater anglers took mostly brown and rainbow trout.

Species composition changes have reduced the number of commercial fishermen operating in Sturgeon Bay. Netting is done throughout the year for yellow perch, lake whitefish and burbot. The economic benefits of sport charter operations are greater than those for commercial landings.

b. With the Project

The specific location and design of mooring facilities for a Type C icebreaker in Sturgeon Bay are not presently available. When more detailed plans become available, we will provide more detailed comments.

Icebreaking could cause polluted sediments in Sturgeon Bay to become resuspended affecting benthic habitat. It could disturb fish, increase under-ice movement, change winter habitat and produce additional stress at a critical time of year. Feeding and spawning areas could also be altered causing disruptions in the sport and commercial fisheries.

If the mooring facilities are located in or near wetlands along the canal and Lake Michigan shore, fish spawning and nursery areas would be adversely affected. Dredging during construction and maintenance of the facilities would displace bottom habitat and associated benthos. Pollutants directly toxic to aquatic organisms could be resuspended and redissolved. Public and private sport fishing could be lost.

Discharges and spills of oil, hazardous materials and toxic substances could be lethal to aquatic organisms depending on the particular substance, concentration and exposure time. During cold weather oil could congeal, sink to the bottom, and destroy or degrade habitat for fish and fish food organisms.

4. Wildlife

a. Without the Project

Land uses along the Sturgeon Bay Ship Canal are urban, residential and industrial. Open fields, croplands, apple and cherry orchards, forests, and wetlands are also present. Whitetail deer, raccoon, eastern cottontail, gray, fox, and red squirrels, red and gray fox, mink and muskrat are important game animals and furbearers.

With Green Bay and Lake Michigan completely surrounding Door County, it is not surprising that waterbirds are an important part of the fauna of Sturgeon Bay. All the waterfowl previously described for Lake Michigan may also be seen in Sturgeon Bay. Mallards, blue-winged teal and wood ducks nest in the immediate vicinity of the canal. The Door Peninsula is an important corridor for migrating raptors and passerines.

Ruffed grouse and woodcock are found in upland areas.

Hunting, trapping, bird watching and nature study are popular activities. Estimates of the amount of participation are not available.

b. With the Project

Icebreaking could destroy wetland vegetation through movement of ice and sediment. Benthic food organisms for waterfowl could be destroyed by sediment movement. Additional open water could attract waterbirds, possibly to areas with insufficient food. Wintering waterbirds would be forced to flee from the icebreaker, using up precious energy reserves. Quantitative predictions of icebreaking effects on wildlife are difficult. It is believed the effects are adverse.

If the facilities would be located in or near wetlands, direct and indirect losses and degradation of habitat would occur.

Dredging poses special problems for wildlife resources in Sturgeon Bay because the sediments are polluted. Substances may be released during dredging which are directly toxic to wildlife or have indirect effects through disruption of food chains. Polluted dredged materials must be contained. The lack of environmentally acceptable disposal sites has prevented maintenance dredging of the ship canal for the past three years. Upland disposal could destroy or degrade terrestrial wildlife habitat.

Discharge or spill of oil, hazardous materials and toxic substances could be lethal to wintering waterbirds and destroy or degrade benthic habitat and organisms.

5. Discussion

Little information is presently available to make quantitative predictions of the project effects on fish and wildlife populations and habitats.

Major lake whitefish spawning grounds have been identified in North Bay, Door County, Wisconsin, approximately 45 miles north of Sturgeon Bay. Other whitefish spawning areas in the northern part of Lake Michigan are likely to be found. Since lake whitefish are fall spawners, winter disturbance of sediments would affect vulnerable eggs and early larvae. Ship trafffic could also affect ice fishing, which occurs throughout the ship canal. Spills or discharges of oil, hazardous materials and toxic substances would adversely impact the eggs and larvae of lake whitefish. Production of benthic organisms could also be reduced.

The location of a mooring facility in Sturgeon Bay is not definite at present. A Coast Guard Station is located at the northeast end of the canal on Lake Michigan. It is not known if sufficent space exists at the station for the additional mooring facility. Several alternate sites should be developed with an environmental assessment for each.

Effects of dredging for new icebreaker mooring facilities may include disruption of fish migration and spawning, reduction in production of benthic organisms, mortality to fish eggs and larvae, and destruction of aquatic or terrestrial habitat from dredged material disposal. Sediments

in the Sturgeon Bay Ship Canal are polluted and can only be disposed of in impermeable containment facilities. None, which are environmentally acceptable, are presently available. A suitable site would have to be obtained prior to dredging.

6. Recommendations

The following recommendations supplement those listed previously for the Great Lakes Basin, Part F.

(1) Conduct studies to reveal the nature, magnitude, spatial and temporal aspects of avian life in and around Sturgeon Bay.

(2) Develop an environmental assessment with several alternate sites for mooring facilities, including availability of dredged material disposal facilities.

H. Traverse City, MI

1. Description of Area

Traverse City is the principal harbor on Grand Traverse Bay, a 30-mile long U-shaped extension of Lake Michigan located in Grand Traverse County, Michigan. A narrow peninsula, referred to as "Old Mission" projects northward from the inner end of the bay, dividing it into east and west arms. Grand Traverse Bay is a relatively deep bay with a large part over 100 feet deep.

Commercial traffic is received at private docks just south of the harbor. Gasoline, fuel oil and coal shipments are regularly received. Cargo averaged 373,800 tons annually for the period 1970-1974.

Sediments of Grand Traverse Bay are primarily sand, silt and clays. Pesticides used on nearby orchards have contaminated bottom material in some areas.

Traverse City State Park is located 2 miles east of the City on the east arm of Grand Traverse Bay.

2. Description of Project

Mooring facilities are proposed for a Type C icebreaker at Traverse City. We assume that dredging will be required to construct and maintain these mooring facilities.

3. Fish

a. Without the Project

Important fish species in Grand Traverse Bay include lake, rainbow, brown and brook trout; chinook and coho salmon; lake and round whitefishes; northern pike, walleye, and yellow perch. Smelt and alewife are locally abundant in spring and summer, respectively. The salmon and trout are stocked in large numbers by the Michigan Department of Natural Resources. Other species spawn successfully in Grand Traverse Bay.

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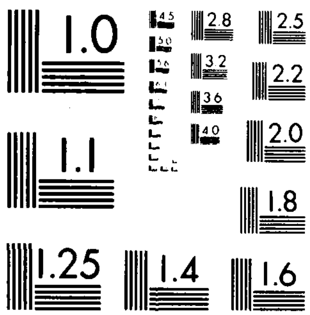

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Traverse City and both arms of Grand Traverse Bay are popular sport fishing areas year-round. All of the above species are taken during the open water time of year. Northern pike, yellow perch, walleye and lake trout are also caught through the ice.

Historically, Traverse City was an important port for commercial lake trout and lake whitefish fishing. With the decline of lake trout, the lake whitefish became the mainstay of the fishery.

b. With the Project

The specific location and design of mooring facilities for a Type C icebreaker in Traverse City are not presently available. When more detailed plans become available, we will provide additional comments.

Because much of Grand Traverse Bay is so deep, the shallow areas are very important. Some fish species use the rocky shoreline areas for spawning. There are few wetlands on the bay. These are extremely important to northern pike and yellow perch as spawning areas.

Icebreaking could cause polluted sediments in Traverse City Harbor to become resuspended affecting benthic habitat. It could disturb fish, increase under-ice movement, change winter habitat and produce additional stress at a critical time of year. Feeding and spawning areas could also be altered causing disruptions in the sport and commercial fisheries.

If the mooring facilities are located in or near any of the few wetlands along the shore, fish spawning and nursery areas would be adversely affected. Dredging during construction and maintenance of the facilities would displace valuable shallow bottom habitat and associated benthos. Pollutants directly toxic to aquatic organisms could be resuspended and redissolved. Public and private sport fishing could be lost.

Discharges and spills of oil, hazardous materials and toxic substances could be lethal to aquatic organisms depending on the particular substance, concentration and exposure time. During cold weather oil could congeal, sink to the bottom, and destroy or degrade habitat for fish and fish food organisms.

4. Wildlife

a. Without the Project

Land uses along the Grand Traverse Bay are urban, residential and industrial. Open fields, croplands, apple and cherry orchards, forests, and wetlands are also present. Whitetail deer, raccoon, eastern cottontail, gray and red squirrels, red and gray fox, mink and muskrat are important game animals and furbearers.

Waterbirds are an important part of the fauna of Traverse City year-round. All the waterfowl previously described for Lake Michigan may also be seen in Traverse City. Mallards, blue-winged teal and wood ducks nest in the immediate vicinity. Up to 750 mute swans are found in the Grand Traverse Bay area year-round. The large birds winter in small open water areas and are fed by local residents.

Ruffed grouse and woodcock are found in upland areas.

Hunting, trapping, bird watching and nature study are popular activities. Estimates of the amount of participation are not available.

b. With the Project

Icebreaking could destroy wetland vegetation through movement of ice and sediment. Benthic food organisms for waterfowl could also be destroyed by sediment movement. Additional open water could attract waterbirds, possibly to areas with insufficient food. Wintering waterbirds would be forced to flee from the icebreaker, using up precious energy reserves. Quantitative predictions of icebreaking effects on wildlife are difficult. It is believed the effects are adverse.

Locating mooring facilities in or near any of the valuable wetlands would cause direct and indirect fish and wildlife losses and degradation of habitat.

Dredging poses special problems for wildlife resources in Grand Traverse Bay because sediments are polluted with pesticides in certain areas. Substances may be released during dredging which are directly toxic to wildlife or have indirect effects through disruption of food chains. Polluted dredged materials must be contained. The lack of environmentally acceptable disposal sites may add to the problem. Upland disposal could destroy or degrade terrestrial wildlife habitat.

Spills of oil, hazardous materials and toxic substances could be lethal to wintering waterbirds and destroy or degrade benthic habitat and organisms.

5. Discussion

Little information is presently available to make quantitative predictions of the project effects on fish and wildlife populations and habitats.

Major lake whitefish spawning grounds have been identified in Grand Traverse Bay. Since lake whitefish are fall spawners, winter disturbance of sediments would affect vulnerable eggs and early larvae. Ship traffic could also affect ice fishing, which occurs throughout the bay. Spills or discharges of oil, hazardous materials and toxic substances would adversely impact the eggs and larvae of lake whitefish. Production of benthic organisms could also be reduced.

Mammals found in the Port Washington Harbor area are those of an urbanized and industrialized environment. The eastern cottontail, raccoon, and gray squirrel are likely residents of the shore areas. Because of the highly urbanized character of the land around Port Washington Harbor, wildlife concerns are mainly limited to birds. The harbor receives notable and significant use by waterfowl, gulls, terns, shorebirds and raptors during spring and fall migration seasons.

A study of winter bird use of the harbors could show where most use occurs and by which species. The same information could be determined for the aquatic biota. It may be possible to channel winter shipping to a lower use area of the harbor.

The following recommendations supplement those listed previously for the Great Lakes Basin, Part F.

(1) Inventory the winter distribution, abundance and species composition of avian and aquatic biota of Port Washington Harbor.

(2) Ship traffic should be restricted to lower use areas of the harbor as indicated by the results of above study (1).

The location of a mooring facility in Traverse City is not definite at present. It is not known if sufficient space exists at the station for the additional mooring facility. Several alternative sites should be developed with an environmental assessment for each. An icebreaker located in Traverse City would have to break 30 miles of ice to reach open waters of Lake Michigan. Adverse impacts of icebreaking and vessel passage on fish and wildlife resources would be reduced by locating the mooring facility in another port on northern Lake Michigan directly on the lake.

Effects of dredging for new icebreaker mooring facilities may include disruption of fish migration and spawning, reduction in production of benthic organisms, mortality to fish eggs and larvae, and destruction of aquatic or terrestrial habitat from dredged material disposal. Some sediments in parts of Grand Traverse Bay are polluted and can only be disposed of in impermeable containment facilities. None, which are environmentally acceptable, are presently available. A suitable site would have to be obtained prior to dredging.

6. Recommendations

The following recommendations supplement those listed previously for the Great Lakes Basin, Part F.

(1) Locate the mooring facility for a Type C icebreaker at Charlevoix or some other mutually-acceptable site instead of at Traverse City.

(2) Develop an environmental assessment with several alternate sites for mooring facilities, including availability of dredged material disposal facilities.

I. Other Harbors

1. Port Washington

The harbor of Port Washington is located on the west shore of Lake Michigan at the mouth of Sauk Creek. The nearest ports, Milwaukee and Sheboygan, Wisconsin, are 29 miles to the south and 27 miles to the north, respectively. Port Washington Harbor consists of a north breakwater 2,537 feet long; a south breakwater 456 feet long extending into Lake Michigan from a privately-owned breakwater; an outer basin and entrance channel 2,400 feet long and 21 feet deep; a west inner basin 490 feet long and a north inner basin 750 feet long both at a project depth of 18 feet. The existing harbor facilities were completed in 1936.

Waterborne commerce at the harbor consists primarily of receipts of coal by the Wisconsin Electric Power Company and petroleum products. Annual commerce for the period 1966-75 averaged 889,300 tons. The traffic in 1975 was 876,913 tons.

Water quality of Port Washington Harbor is similar to that of adjacent Lake Michigan with the exception of suspended solids and temperature. Sediment contributions from Sauk Creek, the turbulent discharge from the power plant and

occasional easterly and southeasterly winds combine to keep suspended solids levels higher within the harbor. Water temperature within the harbor is generally slightly higher than Lake Michigan temperatures due to heated effluent from the power plant.

Port Washington Harbor is usually ice-free due to heated effluent discharged from the local power plant. The area outside of the harbor is usually ice free due to predominant offshore winds. Detailed studies indicate that no additional harbor modifications would be required to facilitate extended navigation.

The sport fishery can be divided into four categories--shore, stream, pier-breakwater and trolling. Estimates of total trips by Wisconsin Department of Natural Resources for shore, pier-breakwater and trolling fishermen at Port Washington in 1976 are 10,200, 20,000, and 22,000, respectively. Estimates of total salmonid catch are 2,847, 1,982, and 6,746 for the shore, pier-breakwater and trolling fishery, respectively.

Commercial fishing out of Port Washington in the past concentrated on chubs, lake herring and yellow perch. A decline in the abundance of these species and an increase in alewife abundance have shifted the fishery to alewives. Commercial fishing for chubs is permitted by the DNR on a limited basis.

Measures should be taken to assess impacts to wildlife and to reduce or eliminate those impacts as necessary. Impacts include: (1) mechanical destruction of benthos, fish eggs and young fish; (2) spills and discharges from ships destroying benthos, fish eggs, and fish of all ages; (3) spills and discharges from ships coming into contact with wildlife; and (4) disturbance of wildlife by increased winter ship traffic.

A study of winter bird use of the harbor could show where most use occurs and by which species. The same information could be determined for the aquatic biota. It may be possible to channel winter shipping to lower use areas of the harbor.

The following recommendation supplements those listed previously for the Great Lakes Basin, Part F.

(1) Coordinate with this Service, the DNR, and other appropriate agencies and parties to develop and conduct a study to reveal the nature, magnitude, spatial, and temporal aspects of avian and aquatic life in and around the harbor.

2. Milwaukee

Milwaukee Harbor is located at the City of Milwaukee, Milwaukee County, Wisconsin, on the western shore of Lake Michigan.

The project includes breakwaters enclosing a 1,200-acre basin; two piers protecting the river mouth; a 30-foot deep approach channel, 300 to 800 feet wide; an entrance channel 28 feet deep to the landward end of the piers, 27 feet deep in a major portion of the south basin, and 21 feet deep in the north basin. The project also provides for river channels with depths of 27 feet in the Kinnickinnic and Milwaukee Rivers lakeward of the first railway bridges on each river and a depth of 21 feet on the remainder of the Kinnickinnic River to South Kinnickinnic Avenue, the remainder of the Milwaukee River to East Buffalo Street, the Menomonee River to 25th Street, the South Menomonee Canal to 13th Street, and Burnham Canal to 11th Street.

A confined disposal facility was completed at Milwaukee Harbor in 1975 for the purpose of containing a 10-year quantity of polluted dredged material. The 48-acre facility is located in the south outer harbor. This area will contain material dredged at Milwaukee and Port Washington harbors. Waterborne commerce at Milwaukee Harbor in 1975 totaled about 3,509,000 tons and consisted of coal, petroleum products, general overseas cargo, building cement, limestone, carferry traffic and miscellaneous commodities. Annual traffic for the period 1966-75 averaged 5,951,000 tons. Carferry steamers operate throughout the year between this harbor and Muskegon and Ludington, Michigan.

In addition to commercial traffic, about 825 recreational boats are permanently moored in the harbor. A marina was recently constructed at the north end of the outer basin.

The most recent analysis indicates that ice conditions in Milwaukee Harbor will not impede winter shipping and no ice control measures are deemed necessary.

Pollution presently precludes the inner harbor from being significant fish habitat or from supporting sport or commercial fish populations.

The waters of the Milwaukee, Menomonee, and Kinnickinnic Rivers, particularly in the reaches near the harbor, receive organic and inorganic waste effluents from local industry and municipal sewage treatment plants and agricultural and urban runoff. The waterborne sediments in these rivers absorb a portion of the pollutants prior to settling. Because of pollution the aquatic life within the river is limited. Sludge worms, snails, and bloodworms characterize the degraded aquatic environment. Oligochaeta are the most common macrobenthic organisms. Slime growths cover aquatic plants, rocks and debris. This is an unsuitable environment for fish and other clean water forms of aquatic life. The waters of the outer harbor, particularly in the areas more distant from the rivers' mouths, are cleaner and are better able to support fish species from the adjacent lake.

The outer harbor is protected by a 3.7 mile system of breakwaters. The water surface area within the outer harbor is approximately 1,300 acres. Existing aquatic habitat

is of sufficient quality to sustain certain fish resources. Rough fish such as suckers, carp, alewives and bullheads dominate the fish population of the harbor. Sufficient stocks of yellow perch, lake whitefish, rainbow smelt, and occasionally trout and salmon support sport fishing activity within the harbor and at existing breakwaters.

The outer harbor waters are used extensively for sailing and recreational boating. Specific data on pleasure boat movements in the north harbor are not readily available at this time. Recreational boating facilities within the north harbor at McKinley Marina are receiving heavy use. Boat registrations in the Milwaukee Standard Metropolitan Statistical Area exceeded 66,000 in 1971 and are continuing to increase. Primary stimulation for the boating increase is believed to be the successful Lake Michigan salmon and trout stocking program.

Various commercial fishing enterprises originate out of the Port of Milwaukee. In 1971, there were 16 commercial vessels operating out of the harbor. Table 1 summarizes the National Marine Fishery Service's commercial fish catch records proximal to Milwaukee Harbor. Commercial fishing enterprises included a contract alewife fishery. The Wisconsin Department of Natural Resources (DNR) list of Great Lakes licenses for 1972-73 indicated that nine commercial fishermen gave Milwaukee as their home; 11 fishermen did so on the 1973-74 list.

Because of a marked decline in the Lake Michigan chub population, commercial fishing for that species is currently limited to assessment netting on a DNR contract basis only.

TABLE 1 - 1971 Commercial Fish Catch Statistics

Grid1/	Species	Pounds
1801	Yellow Ferch	256
1802	Yellow Perch	18
1901	Rainbow Smelt	1
	Suckers	2
	Yellow Perch	821
1902	Trouts	5
	Lake Whitefish	14,808
	Chub	175,667
2002	Alewife	387
	Carp	9
	Trouts	2
	Chub	27,133
	Suckers	28
	Yellow Perch	42,179

1/ See Figure 1

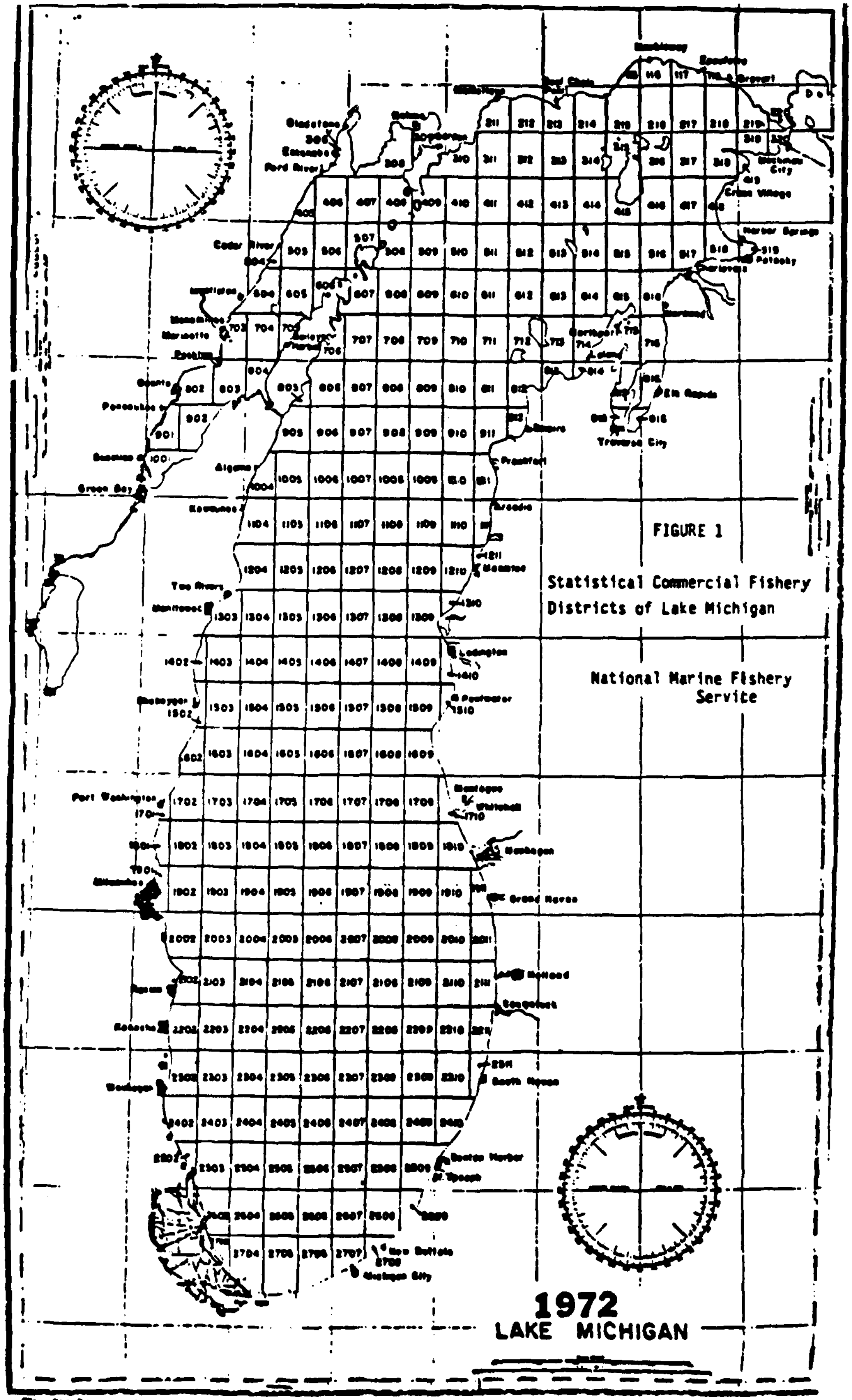


FIGURE 1

Statistical Commercial Fishery Districts of Lake Michigan

National Marine Fishery Service

Mammals found in the Milwaukee Harbor area are those of an urbanized and industrialized environment. The eastern cottontail, raccoon, gray squirrel, Norway rat and other small mammals are likely residents of the shore areas. Reptiles and amphibians also occur in the harbor area.

Because of the highly urbanized character of the land around Milwaukee Harbor, wildlife concerns are mainly limited to birds.

Milwaukee County itself is strategically located with respect to the movements and wintering areas of numerous avian species. Long before the confluence of the Menomonee, Milwaukee and Kinnickinnic Rivers was settled the natural harbor was a winter gathering place for thousands of waterfowl. It continues to be so today. The harbor also receives significant use by gulls, terns and raptors during spring and fall migration seasons.

About 8,000 ducks, mostly oldsquaw and other diving ducks, and nearly 1,000 gulls winter at the harbor. Milwaukee Harbor is probably the most important coastal area of Wisconsin in terms of the number of wintering waterbirds.

Snowy owls regularly winter around the harbor feeding on sick or crippled waterbirds. Other species of owls are also seen. Shorebirds utilize this harbor during spring and fall migrations.

3. Chicago

Located at the confluence of the Chicago River and Lake Michigan, Chicago Harbor provides recreational and industrial services to metropolitan Chicago. Located within the harbor are several yacht clubs, an overseas terminal, Navy Pier, numerous small dockages and a large city filtration plant.

Lakeward of the Chicago River locks, the fish population is the same as found in Lake Michigan. Fishing pressure is light except near Navy Pier and between the locks and the filtration plant. At least one charter vessel fishes the outer breakwater for yellow perch. During April and May, salmon fishermen work the area inshore of the breakwater.

Because of the extremely degraded condition of the Chicago River, the fish population on the river side of the locks consists of species most tolerant of polluted waters. Carp, goldfish and green sunfish are the dominant species when conditions allow.

A Type B icebreaker will be stationed at Chicago. No new mooring facilities will be required.

Wildlife in or near Chicago Harbor consist of species that have adapted to man's presence and can survive in an intensely commercialized environment. Waterfowl can be found occasionally in the area. They may be residents of nearby parks.

4. Burns Waterway

Burns Waterway Harbor, located between Gary, Indiana and Indiana Dunes National Lakeshore, is a federal deep-draft harbor serving the Port of Indiana and Bethlehem Steel and Midwest Steel Companies.

No modifications are planned for Burns Waterway Harbor.

Burns Ditch Waterway, just west of Burns Harbor, has received extensive plantings of salmon and trout from the Indiana Department of Natural Resources. Projected returns for the Fall 1977 run were 86,000 chinook salmon, 108,000 steelhead and 36,000 brown trout. Boat and bank fishermen enjoy a high quality recreational opportunity during the months of September, October and November. Spring runs (April, May and June) provide additional fishing.

Bethlehem Steel employees have access to an outfall area that serves to congregate fish from Lake Michigan proper. Yellow perch, walleye, drum, carp, white bass and bullheads are regularly caught.

Alteration of the terrestrial environment to facilitate industrial development has eliminated most wildlife from Burns Harbor and Waterway. Waterfowl may use open water areas near the harbor.

5. Gary

Gary Harbor is a private facility operated by the United States Steel Corporation. Iron ore and coal constitute the bulk of cargo handled.

No modifications are planned for Gary Harbor.

Yellow perch congregate around the Gary Harbor breakwater. Other Lake Michigan fishes can be taken lakeward of the harbor entrance. Fishing pressure is very light in this area. Inside the harbor polluted conditions favor non-game fish such as carp and goldfish. No management plans are in effect for Gary Harbor.

Water conditions at this harbor will play the decisive role in determining future fishery success. Increased traffic will be detrimental to water quality and fishery resources. Vessel operations during the winter season might cause increased mortality due to increased stress.

Gary Harbor is totally developed. Terrestrial wildlife is limited to urban species. Waterfowl may use open water in the harbor as a resting area.

No adverse effects are expected due to the navigation season extension program.

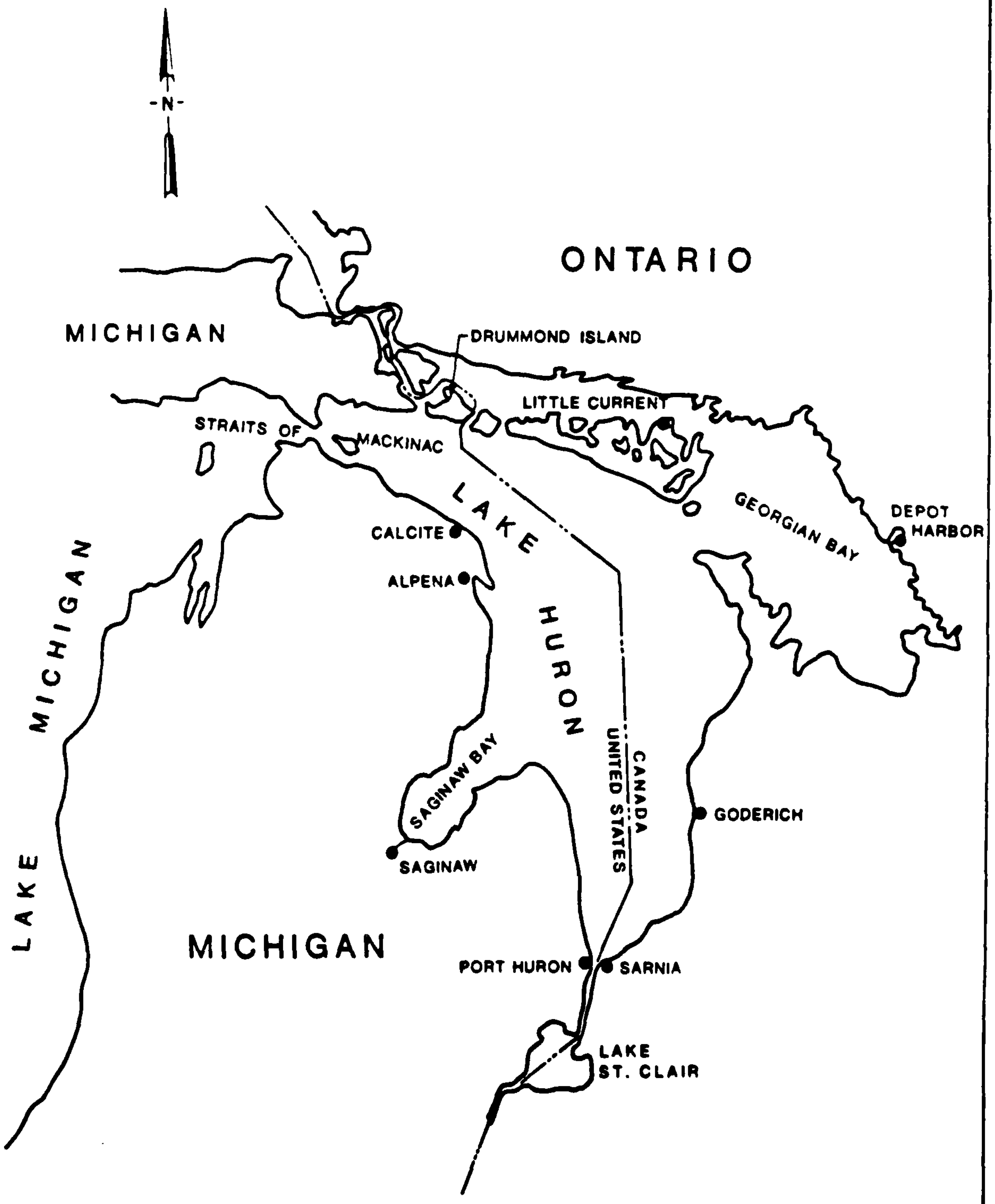
VI. LAKE HURON - MAIN LAKE, ISLAND, MAJOR BAYS, CANADIAN WATERS

A. Description of Area

Lake Huron ranks second in size to Lake Superior and lies in both the United States and Canada. The lake is 247 miles in length, 100 miles wide and has a total surface area of approximately 23,000 square miles. The maximum recorded depth is 750 feet. More than half of the lake's surface and more than two-thirds of the total drainage basin are in Canada. Major Michigan harbors on Lake Huron include Calcite, Stoneport, Alpena, Alabaster, Bay City, Saginaw, and Port Huron. Canadian harbors include Sarnia and Goderich, Ontario. (See Figure VI-A-1)

Lakes Michigan and Huron, connected by the Straits of Mackinac, act as one hydraulic unit with the same water level. The level of Lake Huron fluctuates from month to month and year to year. In addition, there may be daily and even hourly fluctuations, known as seiches, that result from a tilting of the lake surface by winds and barometric pressure.

Lake Huron has large areas that are protected from deep lake currents. These areas are North Channel, which is one of the first areas to become ice-covered, and Georgian Bay. Lake Huron proper has three areas that freeze over early in the winter. These areas are the Straits of Mackinac, Saginaw Bay, and the southern part of the basin in the Port Huron area. Normally, the greatest extent of ice cover is about 40 percent of the lake surface. During a severe winter, ice may cover as much as 80 percent of the lake.



LAKE HURON

FIGURE VI -A-1

The main part of Lake Huron has good water quality and has deteriorated only slightly from conditions which existed in the early 1800's. On the United States side, one problem area, Saginaw Bay, exhibits high concentrations of nutrients, coliforms and total dissolved solids originating from the Saginaw River System. On the Canadian side of the lake, Georgian Bay and the North Channel experience similar conditions in various harbors and estuaries.

A unique, isolated unit of the Michigan Islands Wilderness Study Area is situated on Scarecrow Island in Lake Huron, at Alpena, Michigan. This 7-acre island, along with two other small island refuges in Lake Michigan were set aside by Executive Order in 1943 as a refuge and breeding ground for migratory birds and other wildlife. The island's tree cover provides nesting sites for great blue herons. The gravel shorelines are attractive nesting sites for herring and ring-billed gulls, while herbaceous growth and shrubs support numerous species of smaller birds. Small temporary wetlands found on the island also attract ducks and shorebirds. The refuge is supervised from Shiawassee National Wildlife Refuge, Saginaw, Michigan. The 8,850-acre Shiawassee National Wildlife Refuge, located at Saginaw, Michigan, provides important migrating and nesting habitat for a variety of ducks, geese and swans.

The Huron National Forest and the Hiawatha National Forest, both managed by the U. S. Forest Service, border portions of the Lake Huron shoreline. The Huron National Forest, consisting of about 415,000 acres, is located in the upper portion of Michigan's Lower Peninsula. The larger Hiawatha National Forest, covering

some 860,000 acres (two separate units) in Michigan's Upper Peninsula, is situated at the northwest end of Lake Huron above the Straits of Mackinac. This forest also fronts Lake Superior at Whitefish Bay and Lake Michigan above the Straits of Mackinac and in the Big Bay DeNoc area. Both national forests are being managed for watershed protection, production of forest products, fish and wildlife resources, and public recreation.

B. Description of Project

As a result of improvements in selected harbors of Lake Huron, additional icebreaking and vessel traffic on the lake itself are anticipated. Areas in which icebreaking will be required include Saginaw Bay, Thunder Bay, passage around Bois Blanc Island and passage between and around Mackinac and Round Islands. Several additional icebreakers will be added to the Coast Guard fleet. New mooring facilities will be required.

The operational measures proposed for implementation for extended season operation on the Lake Huron portion of the system are:

<u>Icebreaking</u>

Icebreaking will be required on the main lake, at harbor entrances, in the harbors, in the tributary lakes and rivers and in the major bays. The icebreakers will be of two types; deep draft polar (Type B) and shallower draft (Type C).

The Coast Guard's preliminary estimate of future icebreaking requirements indicates that one new Type C icebreaker would be required for duty on Lake Huron. Mooring facilities at Bay City, Michigan will be constructed to accommodate that icebreaker. In addition, it is proposed that commercial icebreaking tugs be stationed in Calcite, Alpena and Saginaw harbors.

Icebreaker Mooring Improvements

In Bay City, mooring facilities and access channels for the icebreakers may have to be constructed. Specific locations and detailed plans are not available.

Vessel Traffic Control

Vessels in transit will be monitored through a series of pre-selected check points. Traffic control is designed to prevent collisions and groundings. The vessels will check in with a traffic center.

Ice/Weather Data Collection/Dissemination Systems

An Ice Navigation Center was established for the Demonstration Program. This center receives and disseminates information on ice conditions, weather and related topics.

Aids to Navigation

These developments include the use of Loran C, navigation lights, beacons and radar reflectors. A fixed navigation light structure with RACON will be installed in the Lake Huron navigation cut. The structure is relatively small and may be located on land. Its specific location has not been selected.

Ice Control Structures

These structures are the proposed ice booms. Ice booms are floating logs or metal cylinders chained together and anchored to the bottom. They serve to prevent ice from shifting or moving downstream. The anchors will be left in place, but the booms will be removed in spring and replaced in fall. One such structure will be placed at the outlet of Lake Huron to keep the drift ice from entering the St. Clair River. A second ice boom will be installed in Saginaw Bay near the entrance to Bay City Harbor.

Air Bubbler Systems

These developments consist of long perforated pipes, a supply pipe and air compressors. The air pressures used in the system would be between 10 and 15 psi, a relatively low pressure. They are not designed to keep an area ice free, but to reduce the thickness of ice so it can easily be broken. In Lake Huron harbors, bubblers are proposed along docks and channels. The air bubbler orifices are spaced about 20 feet apart.

Dredging

Dredging proposed for Lake Huron winter navigation includes that amount needed in harbors to accommodate icebreaker mooring facilities. No information is available on the disposition of the dredged material. Most dredging would occur in harbors where polluted sediments may be present. Plans include dredging a channel from the regular navigation channel to mooring facilities. If the spoil is determined to be polluted, it must be deposited in confined spoil areas.

Compensating Works

There will be no compensating works on Lake Huron proper. The St. Clair-Detroit River compensating works should have little effect on the water level of the lake. The compensating works will be designed to minimize the effects of ice booms at the head of the St. Clair and Detroit Rivers.

Shoreline Protection

There presently are no proposed shoreline protection measures for the Lake Huron area. Studies are underway to define areas of shoreline erosion and structure damage.

Island Transportation Assistance

Island transportation assistance on Lake Huron will consist of measures to ensure the operational capability of the Drummond Island ferry during winter navigation. Those measures consist of a short ice boom to deflect drifting ice away from the island dock and ferry track bubblers of unspecified length to maintain a weakened ice zone. A variety of contingency measures are being considered in case the ferry breaks down or fails to navigate through the drift ice pack.

Water Level Monitoring

Monitoring will be done in the connecting channels. There would be no effects on fish and wildlife resources.

Vessel Speed Control and Enforcement

The U. S. Coast Guard is responsible for the control and enforcement of vessels and their speed. The Coast Guard sees no need to change present speed limits because shoreline damages and erosion are the responsibility of the vessel operator. Cause of damage is determined by the Coast Guard.

Safety/Survival Requirements

These developments will not affect the fish and wildlife resources.

Vessel Operating and Design Criteria

These criteria have been developed to promote safe vessel operation in all United States waters. For vessels operating in ice, the criteria are explicit about hull strength, power plant size, strengthened steering mechanisms, propellers and other special gear. There also are special criteria for oil and hazardous substance transporters. Enforcement of the criteria will reduce the probability of accidents and serious spills. Vessels do and will continue to operate that are not in compliance with these criteria. No additional regulations or enforcement are proposed in the plan.

Search and Rescue Requirements

These requirements will not affect fish and wildlife resources.

Oil/Hazardous Substance Contingency Plans

The Coast Guard is the designated responsible agency for these plans on the Great Lakes. These plans include one stockpile of materials at Cleveland to contain spills. A Regional Response Team also exists and the Service is a member. The National Strike Force, a highly trained Coast Guard unit, has a four-hour response in the Great Lakes area. The actual cleanup of a spill is contracted to private companies.

Vessel Waste Discharge (Non-human) Requirements

These requirements and standards have been set and enforced by EPA. They include the equivalent of secondary treatment. No wastes are to be discharged into the waters of the lakes. The problems of disposing wastes in special harbor facilities are being studied.

Environmental Plan of Action

The Fish and Wildlife Service and the Corps of Engineers have determined that much information is needed to make a precise evaluation of project effects. The EPOA is an attempt to acquire the needed information and predict the effects of the project. The plan also will provide for monitoring of project developments to verify predictions, and will culminate in recommending ways to eliminate or minimize adverse effects.

C. Fish

1. Without the Project

Lake Huron has supported a commercial fishery since the late 1800's and presently ranks third among the Great Lakes in commercial fish landings. On the United States side, the fishery is located in the lake proper and in Saginaw Bay.

Commercial fish production in the United States waters reached its maximum about the turn of the century. In Canadian waters, commercial production reached its peak about 1892. From the early 1900's until the mid-1930's, total annual production was nearly constant. In the late 1930's, sea lamprey predation was reflected in the decline in whitefish, lake trout and sucker landings. An almost steady decline in total production continued through 1966. Accompanying this decline was an increase in the proportion of lower valued species such as chubs and yellow perch in the commercial catch. Other species including whitefish, sucker, sauger and walleye also declined during those years.

The alewife is currently the dominant fish species in Lake Huron. High fecundity, relative absence of predators and effectiveness as a filter feeder has given the alewife a competitive advantage over native and introduced species (herring, shiners, smelt, kiyi, and bloaters). Consequently, the alewife has been responsible for major changes in the lake's food chain. It is the principal forage fish for major lake predators.

The present-day United States commercial fishery in Lake Huron is composed mainly of carp, whitefish, catfish, yellow perch and suckers. The value of the United States commercial harvest for these five species for the period (1975-1977) is as indicated:

	1975 lbs./$	1976 lbs./$	1977 lbs./$
Carp	600,000/ 51,000	716,000/ 63,000	787,000/ 73,000
Whitefish	405,000/271,000	486,000/321,000	444,000/425,000
Yellow Perch	268,000/117,000	322,000/170,000	257,000/134,000
Suckers	110,000/ 7,600	126,000/ 11,000	105,000/ 9,200
Catfish	282,000/114,000	378,000/150,000	403,000/161,000

A major constituent of the commercial chub catch of Lake Michigan and Huron until the 1950's was the longjaw cisco. This formerly abundant fish is now officially listed as a Federally endangered species. Only seven specimens were taken during intensive studies of southern Lake Michigan in 1962-1964. The decline of the species has resulted from sea lamprey predation, intensive commercial fishing for large ciscoes and increased competition from the small bloater and alewife in Lakes Michigan and Huron.

A substantial sport fishery for lake trout existed in both Canadian and United States waters in the early 1900's. The Canadian fishery was concentrated in southern Georgian Bay in the vicinity of Parry Sound and along the east side of the Bruce Peninsula. In the United States the lake trout fishery existed in Michigan offshore waters north of Alpena. That fishery ceased to exist with the collapse of the lake trout populations in the early 1940's.

Coho salmon were introduced to Lakes Huron and Michigan to help control the alewife and provide game fish. Lake populations depend on hatchery plantings. As the ice breaks up in late March open-water coho fishing begins in southern waters of Lakes Michigan and Huron. Coho will remain in shallow waters as long as water temperatures remain below 60°F. As surface waters warm coho move offshore into deeper waters. By July, they are usually found several miles offshore. Chinook salmon appear in shallow near-shore waters about mid-July. After September they enter the spawning streams. Chinook may be found in offshore waters in spring and early summer. This species prefers 50-55°F and is similar to coho salmon in habits and preferences.

Rainbow trout, or "steelhead", were introduced to Lake Huron in 1876. The steelhead make spring and fall upstream runs in Lake Huron tributaries. Fall runs occur in September and October. The fish overwinter in the streams after spawning. They return downstream in May and June. In late spring and summer steelhead can normally be found in open waters within a mile of shore and at depths less than 50 feet.

The sport fishery of Lake Huron is recovering as a result of the sea lamprey control program, Federal, State and Canadian fish stocking programs and fishing regulations and restrictions. Important winter fisheries exist in the Straits of Mackinac area between Bois Blanc Island and the Lower Peninsula of Michigan, in the Majors Shoal area and in St. Ignace Harbor. In the first two areas, lake trout is the species most often taken. St. Ignace Harbor provides ice fishing for northern pike and yellow perch. Commercial ice fishing is conducted generally in the waters west of Goose Island Shoal and north of Mackinac Island. The commercially important species taken there include lake trout and lake whitefish.

The fishery of Lake Huron will continue to change whether or not the navigation season extension project is implemented. The degree and nature of change would depend upon fishery management efforts undertaken. To visualize future conditions, certain basic assumptions must be made. The Federal Government's mandate to clean up the nation's waters is expected to provide the impetus and necessary safeguards to protect and improve water quality. It is also anticipated that future shore developments will be implemented in a more environmentally sound manner than most prior developments. It is reasoned that dredge and fill activities along shorelines and tributary streams, in addition to point source effluent discharges, will be subject to more stringent requirements and regulations than are now in effect. For fish and wildlife planning purposes, we shall assume that Lake Huron waters will at least maintain their present level of quality.

The rapidly developing sport fishery for lake trout in portions of Lake Huron is expected to continue its present trend. Sea lamprey populations have been reduced and there has been a dramatic decrease in lamprey predation on lake trout, salmon and steelhead. Lake trout populations are rebounding in response to control efforts and ongoing lake trout restocking programs. The Fish and Wildlife Service envisions the continuation of lamprey control activities and lake trout plantings in the Great Lakes.

Coho and chinook salmon plantings in Lake Huron, which are primarily the efforts of the Michigan Department of Natural Resources, have proven to be one of the most popular and successful management programs carried out on the lake. It has dramatically rejuvenated sport fishing in the lake and on certain tributary streams. Again, an assumption has been made that these salmon fisheries will be perpetuated and allowed to expand through stocking and management by the State of Michigan to satisfy sport fishing demands of present and future anglers.

With the continuation of the Sea Lamprey Control Program, lake trout planting, and the regular stocking of salmon, Lake Huron has the potential of providing outstanding sport fishing for many hundreds of thousands of anglers annually. The prospects for a large resurgence of commercial fishing is conjectural. The future Lake Huron sport fishery without the winter navigation season extension can be expected to be improved and more heavily utilized by fishermen.

2. With the Project

Activities associated with an extension to the navigation season may affect fish and wildlife resources and their habitats in some areas of Lake Huron. At the present time, several areas of concern have been identified. Other presently unknown adverse impacts may be revealed through implementation of the Environmental Plan of Study for the Winter Navigation Program.

The following is a listing of various segments of the project with anticipated effects on the fish and fisheries of Lake Huron.

Icebreaking

Icebreaking will take place on the open lake, in harbors and bays. The effects of this activity are thought to be concentrated in the near-shore areas, shallow bays and harbors. Propeller wash could cause sediments to become resuspended displacing benthic organisms. Fish would be exposed to turbulent currents causing additional stress. Loss of fishery resources could result from both effects.

Vessel Traffic

Vessel traffic through the Straits and between Mackinac and Round Islands can be expected to interfere with recreational ice fishing. We have been informed that during the Demonstration Program, Mackinac Island residents reach the Majors Shoal fishing area by placing planks across the vessel tracks.

Icebreaker Mooring Improvements

Additional icebreakers would need mooring facilities and pier space. An access channel may be needed between the navigation channel and the pier. The project-plan does not give enough detail to determine what resources may be affected. Type C icebreakers are proposed to be stationed at St. Ignace and Bay City in Saginaw Bay. They may interfere with ice fishing activity in the harbor. Operation of icebreakers in these harbors may also stress fish wintering there. The seriousness of that stress would depend upon the frequency of icebreaker passage through those harbors.

We assume that mooring facilities will be located at or near existing Coast Guard facilities. More detailed discussions and recommendations are contained in the appropriate harbor sections of this report.

Ice Control Structures

Ice booms are proposed at the outlet of Lake Huron and at the entrance to Bay City Harbor in Saginaw Bay. Ice booms, themselves, do not appear to have significant effects on fish resources. The anchors will be buried in the bottom and left in place. This could cause minor losses of habitat.

Air Bubbler Systems

The air bubblers, if operated as described in the proposed plan, should not have significant effects on the fishes of Lake Huron. Air pressures would not produce an air curtain effect because the jets are too far apart and the bubbles would not spread far enough to meet. Currents generated would probably not be strong enough to resuspend bottom sediments. The operating plan does not state whether the bubblers would be operated continuously or intermittently. There might be a local increase in dissolved oxygen levels. Other effects will be discussed in the appropriate discussion sections.

Dredging

No dredging is proposed for Lake Huron proper. However, an estimated 12 million cubic yards of spoil from dredging in the St. Marys River could be dumped in the lake in 100-150 feet of water. Though the material is not classified as polluted, its deposition in Lake Huron could be either extremely detrimental or beneficial depending upon the area(s) chosen for dumping, the method of dumping (i.e., piling the spoil or spreading it over a large area) and the time of year dumping takes place. Of primary concern are the potential impacts on lake herring and lake trout spawning grounds. Earlier comments regarding the questionable need for dredging in the St. Marys River to facilitate an extended navigation season should be considered (Section III).

Fishery resources of Lake Huron harbors would be adversely affected by the proposed dredging of access channels for icebreaker mooring facilities. Spoil disposal also would have adverse effects. More detailed discussions of this development will appear in the appropriate harbor sections.

Island Transportation Assistance

The described island transportation assistance for the Drummond Island ferry is not expected to have a significant effect on the fisheries of Lake Huron.

Vessel Speed Control and Enforcement

This part of the plan could have a profound effect on fishery resources in the basin. Vessel speed is one of the factors controlling the pressure waves that can occur in confined channels. Areas in Lake Huron which would appear particularly susceptible to wetland or shallow water fish habitat destruction include the shoals surrounding Bois Blanc, Round and Mackinac Islands, and islands adjacent to the dredged channels leading to Bay City in Saginaw Bay and Alpena Harbor in Thunder Bay. Excessive vessel speed has caused environmental damages in other parts of the system. Fishery resources have been eliminated directly and their habitat and food supply reduced. Without adequate vessel speed limits and enforcement fishery resources could be severely affected.

Vessel Operating and Design Criteria

Presently there are ships operating in the Great Lakes which do not have the modifications outlined in the Coast Guard's operating and design criteria. Fishery resources and human lives are imperiled because ships have not been modified to include needed safety features. Strict requirements incorporating these modifications for winter navigation, would reduce the chance of a major disaster.

Oil/Hazardous Substance Contingency Plans

The lack of compliance with the operating and design criteria causes the probability for a spill to increase. Existing contingency plans are untried in winter. Several of the described contingency plan segments do not adequately protect fishery resources. The National Strike Team response time of four hours is inadequate for a spill in the flowing waters of the connecting channels. A spill could travel a long distance downstream in that time. The containment booms have not performed satisfactorily even under more ideal conditions than found in winter. Response time for the regional teams also is too long. By the time cleanup equipment is on the site, the spill can extend downstream or downwind a considerable distance. Fish habitat could be irreparably damaged. Fish eggs in the area would be destroyed. Spawning habitat could be made unusable even if fish eggs are not present. A spill also could destroy the benthic community since heavier petroleum products will sink to the bottom. Benthos are an important food source for certain lake fishes. Existing clean-up capabilities do not appear adequate to prevent serious environmental damage.

Environmental Plan of Action

Much information concerning fishery resources is needed to make a more detailed and accurate evaluation of project impacts. Accurate fish stock assessments, spawning area surveys and other baseline studies are proposed in the EPOA. The EPOA will also provide for monitoring studies and will result in recommendations to eliminate or minimize adverse environmental impacts.

D. Wildlife

1. Without the Project

The Lake Huron Basin contains a diversity of high quality wildlife habitat. The heavily forested northern half of the basin provides excellent habitat for big game, small game, furbearers, songbirds and a wide variety of other wildlife. Big game animals include whitetail deer, black bear and elk. Game birds include turkeys, ring-necked pheasants, bobwhite, ruffed grouse and woodcock. Small game animals include snowshoe hares, eastern cottontails, and grey fox, and red squirrels.

The shoreline, islands, wetlands and shallow waters provide feeding, resting and nesting habitat for many waterfowl, shore and wading birds, colonial nesters and songbirds. Waterfowl commonly seen in the basin include whistling swan, Canada goose, mallard, pintail, black duck, gadwall, American widgeon, northern shoveler, blue-winged and green-winged

teal, wood duck, redhead, canvasback, ring-necked duck, lesser and greater scaup, common goldeneye, bufflehead, oldsquaw, scoters, ruddy duck, and mergansers. Herring gull, ring-billed gull, common tern, Forster's tern, black tern, black-crowned night heron, double-crested cormorant, and great blue heron all nest in the basin.

Although large numbers of waterfowl winter in Michigan, the state is not considered a nationally important wintering area. Lake Huron waters, with the exception of Saginaw Bay, support relatively few birds. Three avian species occurring within the Lake Huron drainage are on the Federal list of Endangered and Threatened Wildlife. The Kirtland's warbler breeds in the northern part of Michigan's lower peninsula, principally in the watershed of the Au Sable River. This species is classified as endangered.

The bald eagle has threatened status in Michigan. Surveys and sightings indicate extensive nesting activity in the Michigan portion of the Lake Huron drainage.

Another endangered species, the Arctic peregrine falcon, migrates through the watershed to and from its tundra breeding area in Alaska, Canada and western Greenland. The endangered American peregrine falcon probably does not occur within the Lake Huron drainage at the present time. It may be reintroduced in the future.

Wildlife resources in the Huron drainage will continue to provide outdoor opportunities for hunting, birdwatching, photography and the other related activities. The quality of outdoor recreation is expected to decline due to crowding and increased competition. In the future, nonconsumptive wildlife use is expected to exceed consumptive use.

The survival of the endangered Kirtland's warbler, Arctic peregrine falcon and bald eagle is conjectural. If sufficient protection is afforded these birds and their critical habitats, they may increase in number and once again become a viable component of their ecosystem.

2. With the Project

Operational measures considered necessary for extended season operation on Lake Huron could produce changes in the environment which would affect wildlife resources.

The following is a listing of the various segments of the project with anticipated effects on the wildlife of Lake Huron.

Icebreaking

Icebreaking will take place throughout the system. The effects are concentrated in near-shore waters, shallow bays and harbors. Propeller wash could cause currents which resuspend sediments and cause bottom scour displacing benthic communities. This would displace used as food by

wintering waterfowl and shorebirds. Icebreaking may also create open water areas which would attract and hold wintering birds.

Icebreaking activities may interfere with the local movements of wildlife species such as white-tailed deer and red fox.

Icebreaker Mooring Improvements

Additional icebreakers would need mooring facilities and pier space. An access channel may be needed between the pier and navigation channel. The project plan does not give enough detail to determine what resources may be affected. More detailed discussions and recommendations are contained in the appropriate harbor sections of this report.

Ice Control Structures

Ice booms are proposed for the lower end of Lake Huron and near the Bay City Harbor entrance in Saginaw Bay. A small amount of open water may remain behind the booms. This may be attractive to waterfowl, but will be over relatively deep water and, therefore, be used only for resting. Boom anchors will be buried in the bottom and left in place. This could cause minor losses of bottom habitat and benthos. The booms would be used only in winter and removed in spring.

Air Bubbler Systems

The air bubblers, if operated as described in the proposed plan, should not have significant effects on wildlife resources. This would be true if bubblers do not create areas of open water. Bubblers, operated at low air pressures, would probably not resuspend bottom sediments. The operating plan does not state whether the bubblers would operate continuously or intermittently.

Dredging

Dredging is not currently proposed for Lake Huron proper. While the deposition of St. Marys River Spoil is proposed for the open lake, we would anticipate no adverse impacts to wildlife as a result of that activity.

Vessel Speed Control and Enforcement

This development, can have a profound effect on wildlife habitat within areas of pressure waves generation. The shoreline, wetlands, aquatic vegetation beds and shallow water areas are particularly vulnerable to this phenomenon. Vessel speed is one of the factors governing the magnitude of these pressure waves. The areas on Lake Huron where pressure waves could be destructive to shoreline and shallow water wildlife habitat include either side of Bois Blanc Island, between Mackinac and Round Islands, adjacent to the dredged channel at Bay City in Saginaw Bay and in Thunder

Bay near the entrance to Alpena Harbor. Excessive vessel speed has caused damages in other parts of the system. Wildlife habitat has been eliminated. Without adequate vessel speed limits and enforcement at the above-mentioned critical areas, wildlife habitat could be severely affected.

Vessel Operating and Design Criteria

As described in the fish section, there are ships presently operating in the Great Lakes which do not have the modifications outlined in the Coast Guard's operating and design criteria. Wildlife resources, especially waterfowl, are particularly vulnerable and imperiled because these ships are not modified and are subject to a higher probability of accident. Strict requirements, incorporating these modifications for winter navigation, would reduce the chance of a major disaster.

Oil/Hazardous Substance Contingency Plans

Existing contingency plans are untried in winter. Several of the described plan segments do not adequately protect wildlife resources, particularly waterfowl. The response times for the National Strike Team and the Regional Teams are too long. By the time the necessary equipment is on site, the spill could extend a long distance, especially when carried by strong currents or driven by winds. Heavier petroleum products will sink to the bottom smothering benthic organisms. Vegetation emerging in spring also could be

affected by a winter spill. In addition to long response times, some clean-up equipment is less than satisfactory. More effective equipment should be obtained and conveniently stockpiled throughout the basin.

Environmental Plan of Action

As was described in the fish section, the plan of action is designed to acquire information that will allow a detailed and accurate evaluation of project impacts.

E. Discussion

Possible impacts of extending the navigation season have been mentioned in a qualitative manner in previous sections. Much information is not presently available to make quantitative predictions of the project effects on fish and wildlife populations and habitats.

Vessel passage through the shoal areas of northern Lake Huron, Saginaw and Thunder Bay is likely to cause resuspension of bottom sediments at depths of up to 40 feet. Although lake trout are not known to be currently reproducing in Lake Huron, the possibility exists that they will again use former spawning grounds. Since both the lake trout and lake whitefish are fall spawners, the Service is concerned that winter disturbance of bottom sediments might adversely impact their egg and larval stages.

Access to traditional fishing grounds will be hampered by maintenance of vessel tracks throughout the winter months. There is also the possibility that vessel movement within harbors will stress wintering fish.

Waterfowl are known to overwinter at various locations in Saginaw Bay that have open water and protection from wind and waves. Winter is a period of stress because of reduced food supplies, crowding and higher energy demands. Additional expenditures of energy that have no return value will be required if birds are forced to flee oncoming ships. There will be additional forced movement to areas where conditions are less favorable. Winter shipping could also have negative impacts on wintering water birds in Saginaw Bay and other areas.

Icebreaking in near-shore areas has the same effects as previously described for vessel passage with the addition of creating unsafe ice conditions for sport and commercial ice fishing.

The Service was not provided with information regarding the necessity of dredging a channel or berth for the icebreaker to be located at Bay City, Michigan. Effects of such dredging may include disruption of fish migration and spawning, reduction in production of benthic organisms, mortality to fish eggs and larvae, and destruction of aquatic or terrestrial habitat from dredged material disposal. Should dredging take place in areas where bottom sediments are polluted, the resuspension of the various pollutants in the water column could produce immediate and long-term toxic effects on benthic organisms, fish, birds and mammals.

The Service has concerns regarding the proposed deep water dumping of an estimated 12 million cubic yards of dredge spoil in Lake Huron. Even though the spoil material consists mostly of rock and is classified as unpolluted, its indiscriminate deposition could produce adverse impacts on fishery resources. Consultation with appropriate natural resource agencies could reduce these adverse impacts.

Spills or discharges of petroleum products, hazardous materials and toxic substances at any time of year produce serious impacts on benthos, fish, waterfowl and aquatic vegetation. The impact would depend on the timing, substance, weather, clean-up effectiveness and other factors.

Spills and discharges are known to be harmful to fish and wildlife. Birds in the water at the site of petroleum spills lose both insulation and buoyancy and, unless only very lightly oiled, almost always die from hypothermia, drowning or poisoning. Even with the best available human intervention a very low percentage of oiled birds survive. Recent research indicates that even small amounts of oil from a bird's plumage can kill the embryos in eggs. Thus, even if the oil is not fatal to the individual bird it could reduce that bird's reproductive success.

Heavy oil under winter conditions can settle to the bottom, smothering benthic invertebrates, fish eggs and larvae. The direct loss of the above organisms can also have serious secondary repercussions on birds, mammals and fish that would normally feed on them during summer months. Ingestion of contaminated

fish and aquatic invertebrates by higher food chain feeders can produce toxic impacts through bioaccumulation. With regard to persistent toxic compounds, impacts may proceed through several higher trophic levels (i.e., invertebrates to fish to larger fish to raptors).

F. Recommendations

The following recommendation supplements those listed previously for the Great Lakes Basin, Part F.

(1) Channel enlargement dredging should not be pursued in the Middle Neebish Channel. An alternative would be the development of a traffic control plan eliminating simultaneous two-way traffic in the existing channel. Should the alternative of vessel traffic regulation (discussed earlier in the St. Marys River section) be determined unacceptable, we recommend that the appropriate State and Federal natural resource agencies be consulted to arrive at a methodology for disposal which would minimize adverse impacts to the aquatic ecosystem of Lake Huron.

VII. ST. CLAIR RIVER-LAKE ST. CLAIR-DETROIT RIVER SYSTEM

A. Description of Area

The connecting channel between Lake Huron and Lake Erie consists of three distinct bodies of water (Figure VII-A-1). The St. Clair River-Lake St. Clair-Detroit River System is an important connecting channel of the Great Lakes that has been heavily involved in international trade and commerce for many years. There are several harbors on both the United States and Canadian sides of the system. The United States harbors include St. Clair, Detroit, Dearborn/River Rouge, Ecorse and Trenton. Canadian harbors are: Sarnia, Courtright, Sombia, Lambton, and Windsor. Of the 24 United States Great Lakes ports engaged in direct overseas trade, Detroit is third in tonnage passed. In addition to heavy commercial shipping traffic, the waterway supports one of the heaviest concentrations of recreational traffic on the Great Lakes.

There are unique areas situated on the St. Clair-Lake St. Clair-Detroit River system. The Wyandotte National Wildlife Refuge, consisting of a small area of land and water on the lower Detroit River provides resting, feeding and nesting habitat for migratory waterfowl and other birds. There are also several historical sites, landmarks and developments situated on the waterway. Fort St. Joseph, the second white settlement in lower Michigan, was established in 1686 and is at Port Huron along the St. Clair River. Numerous historical dwellings or their former sites are found along the Detroit River. Two nationally-known developments of modern times are Dearborn's Greenfield Village and Henry Ford Museum developed by the Edison Institute.

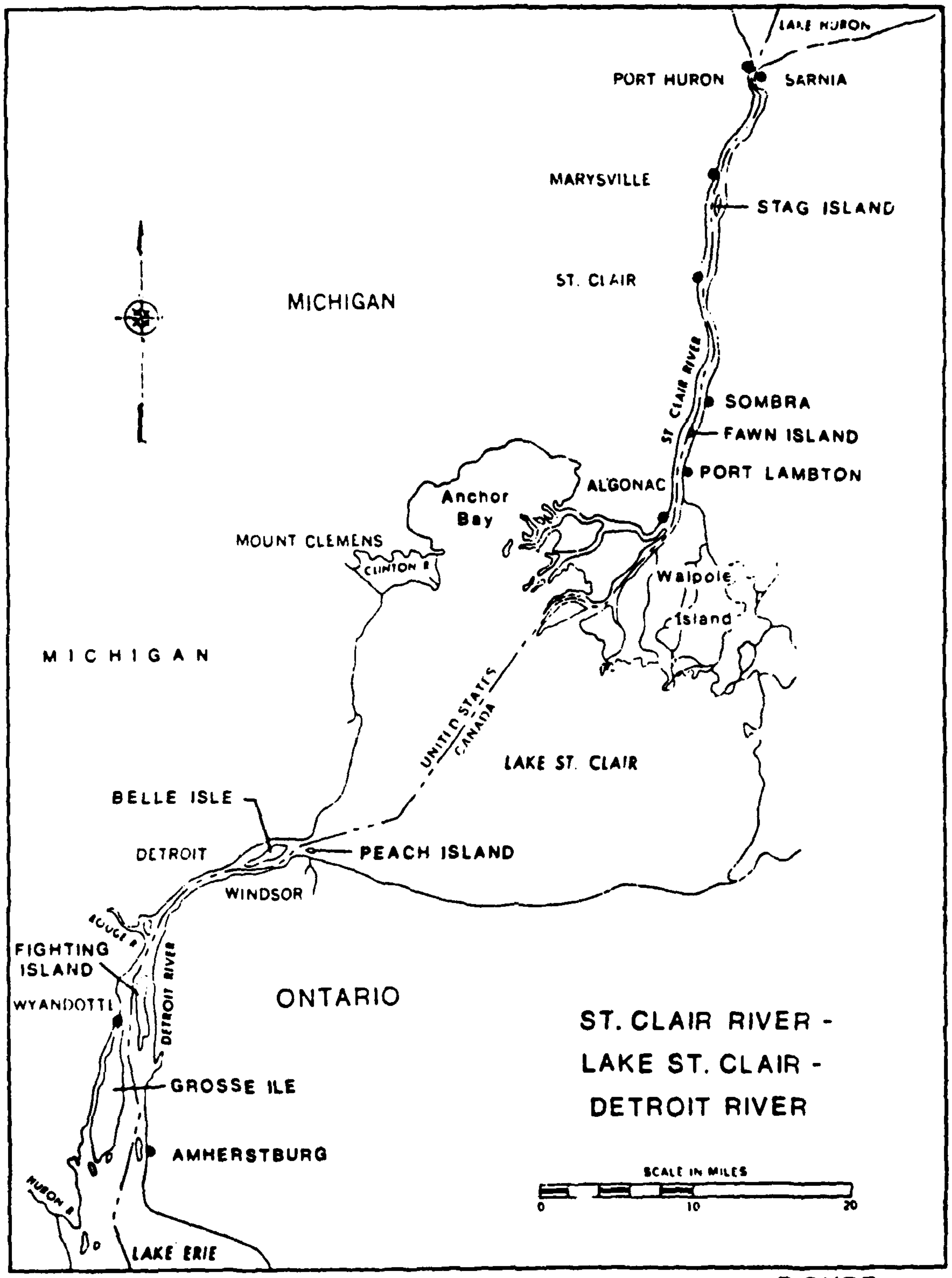


FIGURE
VII-A-1

St. Clair River

The St. Clair River, which flows from Lake Huron to Lake St. Clair, carries the outflow from Lake Huron. The length of the river is about 39 miles. It drains 1,180 square miles of land in the United States. The upper river contains two islands, Fawn (Woodtick) and Stag. The river has a 1300-foot rapids section with a velocity of four miles per hour located near the Blue Water Bridge at Port Huron. The lower river (delta portion) is commonly called the St. Clair Flats. The St. Clair River has a velocity of about two miles per hour when it enters Lake St. Clair.

The banks of the river are composed of clay and sand and are quite steep. The American bank is more highly developed than the Canadian, with the exception of the area immediately around Sarnia, Ontario. The St. Clair River rises and falls an average of one foot in any given year, with occasional seiches of up to two feet caused by high winds. These changes usually occur in consonance with the lake level variations in Lake Huron.

Water quality throughout the St. Clair River is generally excellent. Principal tributaries of the St. Clair River in Michigan are the Belle, Black, and Pine Rivers. These tributaries do not meet present water quality standards. Some degradation occurs in localized areas where tributaries join the river, but these effects are not measurable a short distance downstream. Ship discharges occasionally cause pollution and aesthetic degradation in the river.

Lake St. Clair

Lake St. Clair is an expansive, shallow, round basin characterized by low marshy shores and a flat sloping bottom. Maximum natural depth is 21 feet. The lake is about 25 miles wide. It has a total surface area of approximately 430 square miles with 268 square miles lying on the Canadian side of the international boundary.

Water enters the lake mainly through the St. Clair River delta. Several rivers and streams also flow into the lake from the surrounding watershed. The dredged ship channel bisects the lake and forms an important connecting link in the waterway between Lake Erie and Lake Huron. The American shoreline is highly urbanized. There are no large commercial, industrial or harbors facilities located along its shoreline.

The normal lake level varies from year to year. During each year the water level has a consistent seasonal rise and fall. Highest stages are reached in the summer months and lowest stages in winter months. In the last five years, the range between the maximum monthly mean stages was between 2.87 feet and 4.53 feet above low water datum. The range between the monthly minimum stages was 1.06 and 3.29 feet above low water datum. The greatest annual fluctuation has averaged 3.32 and the least 0.88 feet.

In addition to seasonal variations, Lake St. Clair is affected by seiches caused by wind action or sudden changes in barometric pressure. The amplitude of these seiches may amount to a foot or more and the period may reach several hours. Lake St. Clair acts as a regulating reservoir or a safety valve for the system.

The Clinton River, a tributary to the St. Clair River, is seriously degraded. High coliform densities sometimes cause substandard bacterial levels around the mouth of the Clinton River, limiting water uses. Corrective programs now underway in the Clinton River Basin will greatly reduce the amount of pollutants discharged into Lake St. Clair.

Detroit River

The Detroit River is 31 miles long and extends from Windmill Point Light (at its confluence with Lake St. Clair) to the Detroit River Light (at its mouth in Lake Erie). The river drains a land area of about 268 square miles in the United States and about 648 square miles in Canada. The upper 13 miles of the river has an unbroken cross section, except at its confluence with Lake St. Clair where it is divided by Peach Island and Belle Isle. The upper river is generally deep with an earth bottom and steep banks.

The lower river is broad with gently sloping banks and has many islands and shallow expanses. The bottom consists of earth and boulders. An exception occurs about six miles north of the south end of Bois Blanc Island where the bottom is typically boulders and bedrock. To provide channels of suitable width and depth for deep draft commercial vessels, extensive rock excavation and dredging had to be accomplished. The current velocity of the river is slow, ranging from 1.4 miles per hour at Windmill Point and in the Fleming Channel to 1.9 miles per hour in the Livingstone and Amherstberg Channels. Each year the river rises and falls about two feet. Seiches of several feet produced by

high easterly or westerly winds raise or lower the water level at the west end of Lake Erie and similarly affect the level of the lower Detroit River. Such changes have been as much as six feet within eight hours. The discharge of the Detroit River for the period of record (1900-1976) has averaged 184,000 cubic feet per second.

The Detroit waterfront extends along the entire upper 13 miles of the river from the head of Fighting Island to Lake St. Clair. Below Belle Isle the river bank has been filled for development and is occupied by numerous large industries, docks and shipping facilities. The River Rouge, a tributary stream, constitutes an important branch channel to Detroit Harbor.

The whole Detroit River is below water quality standards and constitutes a problem area in the Great Lakes. The upper ten miles of the Detroit River, from Lake St. Clair to the junction of the Rouge River, is substandard because of high coliform densities and iron concentrations. During dry weather periods this reach has better water quality. Precipitation produces combined sewer overflows within Detroit causing excessive coliform and other pollutant concentrations.

The lower 20 miles of the Detroit River, from the junction of the Rouge River to Lake Erie is also substandard in water quality. This reach receives effluents from municipal sewage treatment plants, industries, commercial enterprises, stormwater overflows and tributary discharges. Located at the confluence of the Detroit and Rouge Rivers, Detroit's main sewage treatment plant serves more than 90 percent of the people in the Detroit area and contributes a tremendous waste load to the river. A large amount of waste is contributed by the flow of the Rouge River.

This reach of the Detroit River displays excessive levels of coliforms, phenols, toxic substances, nutrients, suspended solids and residues.

Historical review and surveys of water quality of the Detroit River illustrates a gradual upgrading of water quality over the past decade as a result of pollution abatement programs. This trend is expected to continue.

B. Description of Project

St. Clair River

Controlling broken Lake Huron ice from filling the St. Clair River and creating ice jams and flooding is a potential problem. The Corps of Engineers has determined that the most promising solution is an ice boom proposed at the lower end of Lake Huron (Figure VII-B-1). An alternative evaluated to reduce ice accumulation in the lower St. Clair River is modification of the channels in the river's delta area to redistribute flow and carry ice away from the navigation channel. This alternative was rejected because it could have a considerable effect on the system's water level regime. Another proposal, that of water level compensating works, accompanies the proposed ice booms (Figure VII-B-2).

Lake St. Clair

Icebreaking is proposed to permit winter navigation on Lake St. Clair. Another measure is an ice boom above Peach Island stabilizing ice in the lower end of the lake and keeping ice from drifting into the Detroit River (Figure VII-B-3).

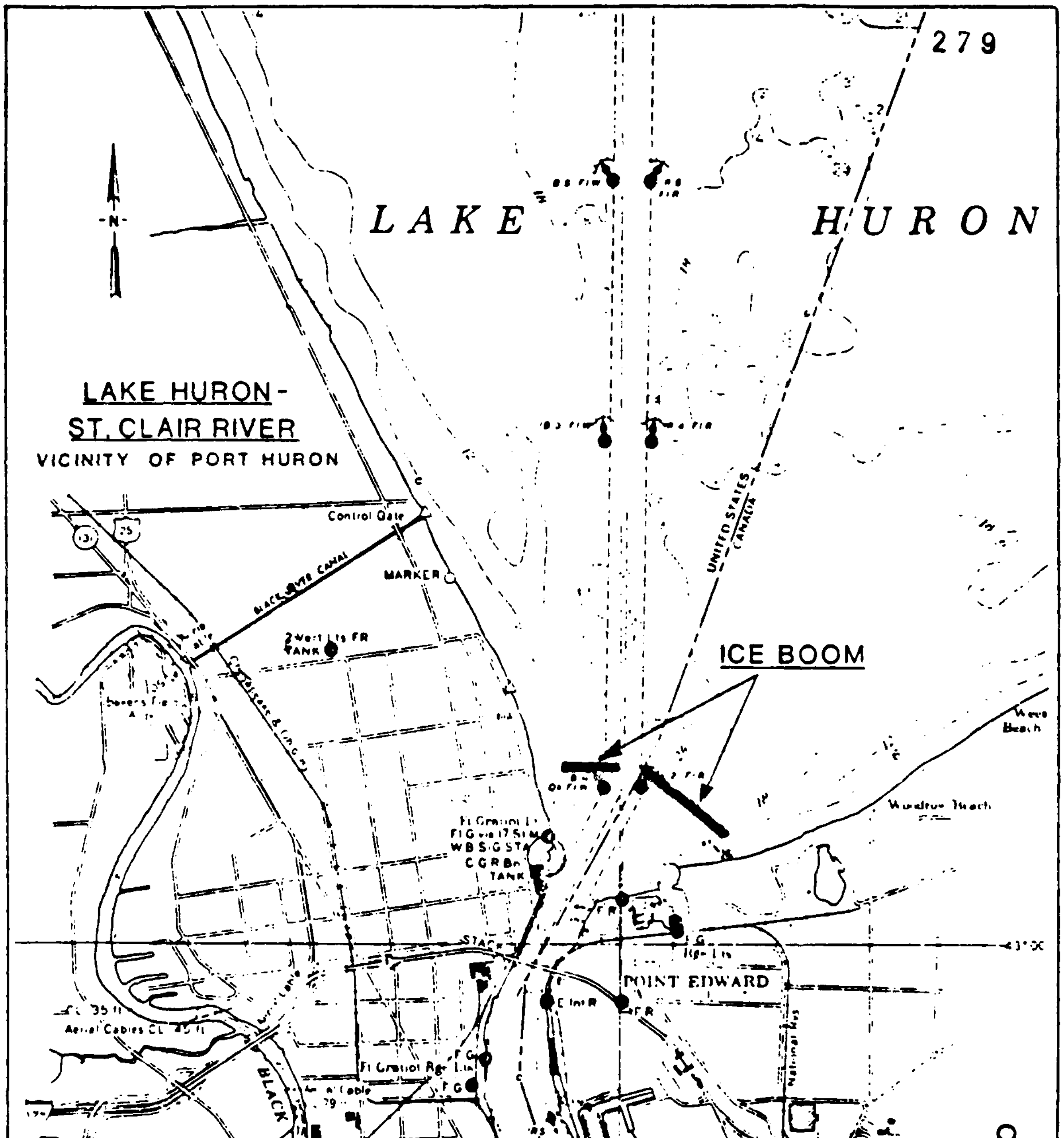
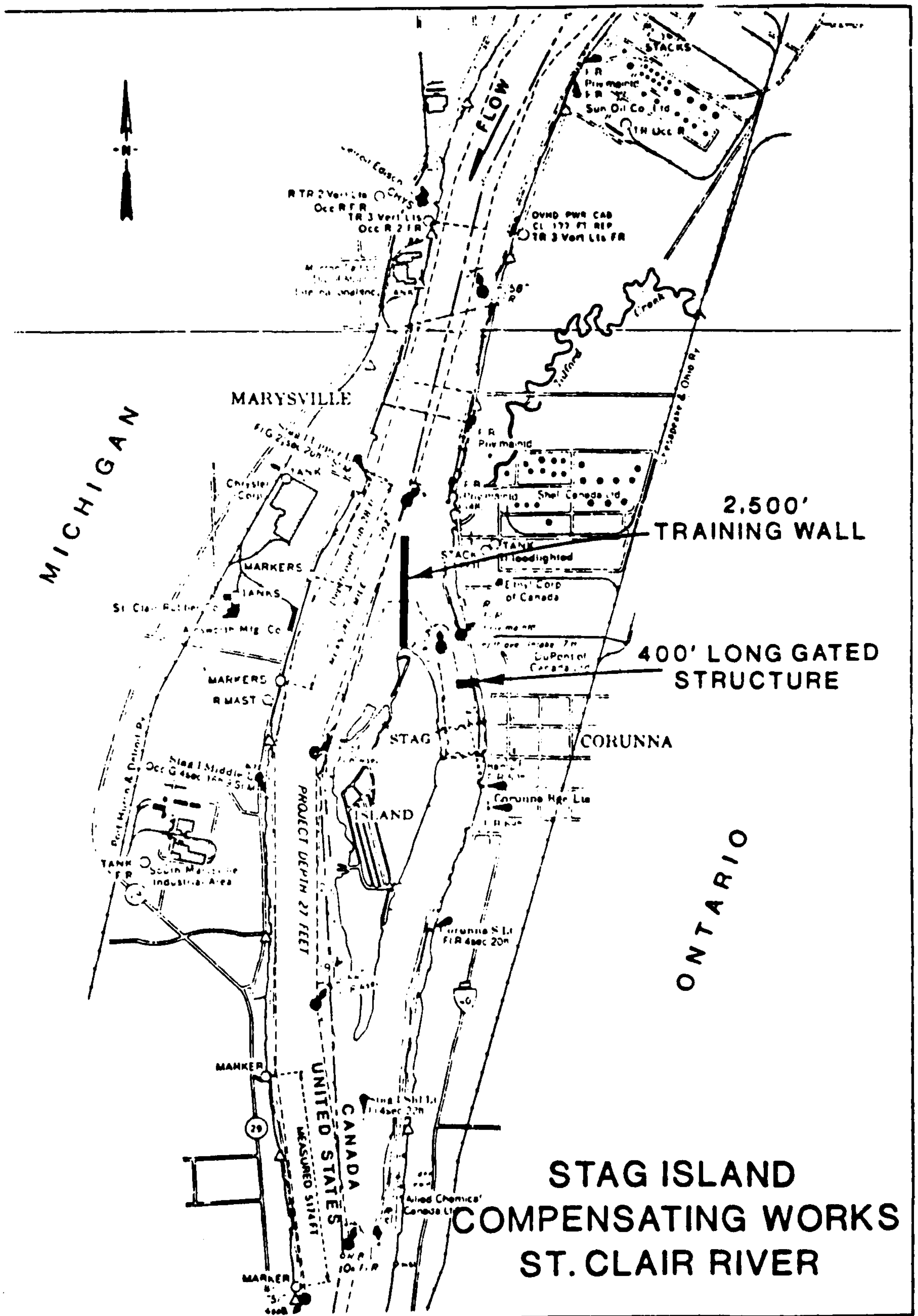
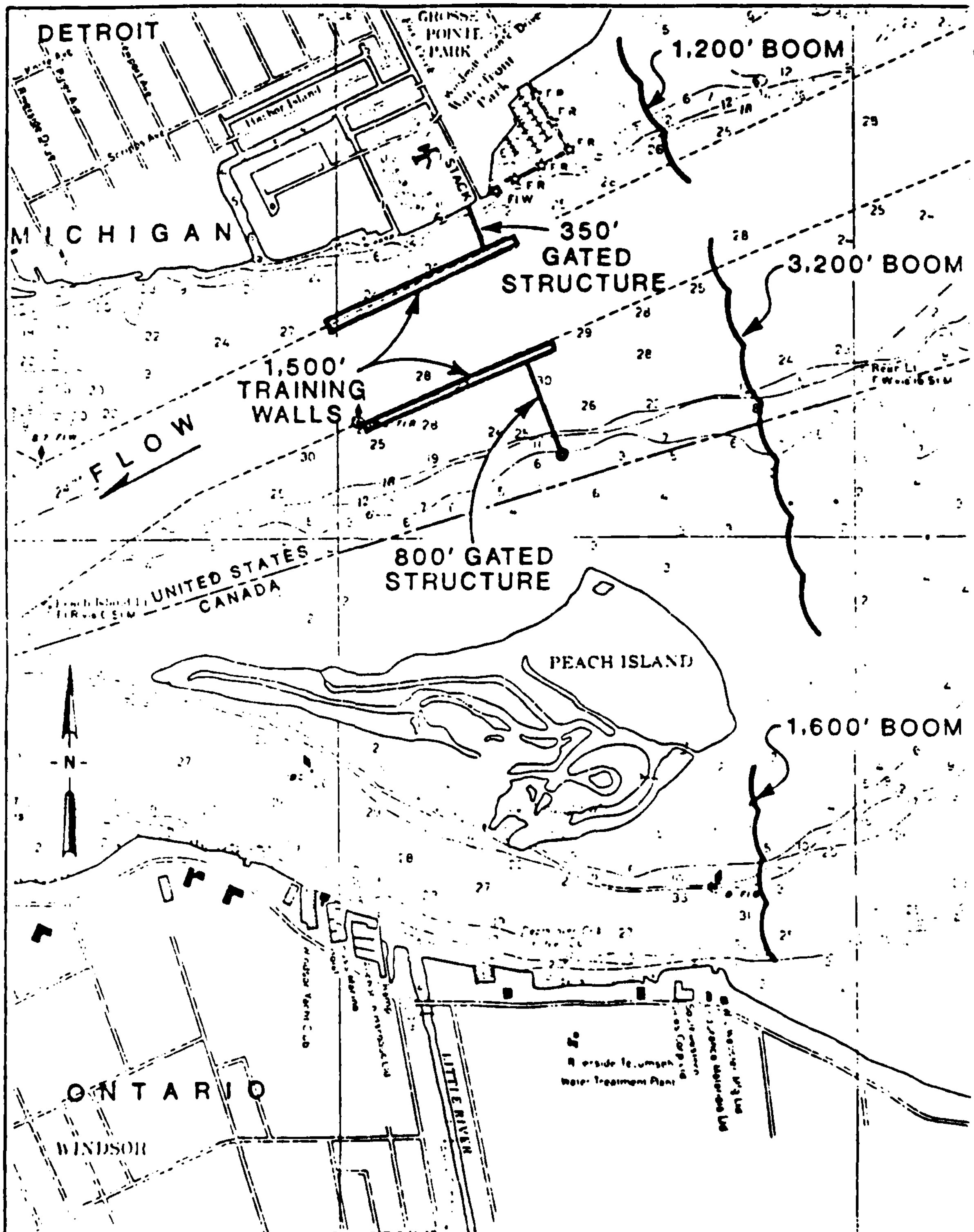


FIGURE
VII-B-1



STAG ISLAND
COMPENSATING WORKS
ST. CLAIR RIVER

FIGURE
VII-B-2



DETROIT RIVER
ICE BOOMS & COMPENSATING WORKS

FIGURE VII-B-3

Detroit River

No major ice problems were identified nor any alternatives developed involving the Detroit River and Detroit Harbor. The compensating works are proposed to solve the water level problem in Lake Erie caused by the proposed ice booms. Alternatives for minor problems at ferry boat crossing between Grosse Isle and the Amherstburg Channel have been developed by the Corps of Engineers. The alternatives proposed the modification of existing ferries to cope with ice problems or the construction of icebreaking ferries.

Proposed Plan

As a result of improvements in selected harbors of Lake Huron, which will be discussed separately, additional icebreaking and vessel traffic on the St. Clair River-Lake St. Clair-Detroit River are anticipated. Areas in which significant icebreaking will be required include the lower portion of St. Clair River, Lake St. Clair and the lower portion of the Detroit River. Several additional icebreakers will be added to the Coast Guard fleet, one of which may require new mooring facilities at Detroit. This may necessitate new dredging projects.

The operational measures proposed for implementation for extended season operation on the St. Clair-Detroit River connecting channel portion of the system are:

Icebreaking

Icebreaking will be required on the St. Clair River (at the lower end), Lake St. Clair and the Detroit River (at the lower end). Ice forms include sheet, drift and pancake ice. The icebreakers will be of two types; deep draft polar (Type B) and shallower draft (Type C). In addition, powerful icebreaking tugs will be used in the harbors. Type B and Type C icebreakers would be stationed at Detroit.

Icebreaker Mooring Improvements

Additional icebreakers would need mooring facilities and pier space. Additional facilities are needed in Detroit but specific locations and detailed plans are not available.

Vessel Traffic Control

Vessels in transit will be monitored through a series of pre-selected check points. Traffic control is designed to prevent collisions and groundings. The vessels will check in with a traffic center. This will not directly affect fish and wildlife resources in this connecting channel system.

Ice/Weather Data Collection/Dissemination Systems

An Ice Navigation Center was established for the Demonstration Program. This center receives and disseminates information on ice conditions, weather and related topics. This will not affect the fish and wildlife resources.

Aids to Navigation

These developments include the use of Loran C, navigation lights, beacons and radar reflectors (RACONS). Four small permanent navigation lights will be constructed: one in Lake Huron approach to St. Clair River (one light with RACON), two in Lake St. Clair (two lights), and one in outer channel of Detroit River (one light with RACON).

Ice Control Structures

Ice booms are floating logs or metal cylinders chained together and anchored to the bottom. The anchors will be left in place, but the floats will be removed in the spring and put back in the fall.

At the lower end of Lake Huron, in the vicinity of Port Huron, Michigan, and Sarnia, Ontario, an ice boom system is proposed to stabilize the natural ice arch which can be disturbed by icebreaking in the channel. The boom would be the heavy duty type, with "catamaran" floats to give it increased stability against the wind-driven ice of Lake Huron. There would be booms extending from both shorelines at a distance of approximately 5,000 feet upstream from Bluewater Bridge, connecting Port Huron and Sarnia. The west boom section would be approximately 1,200 feet long and the east boom section 3,200 feet long. An opening approximately 500 feet wide would be left between the boom ends at the navigation channel to allow for vessel passage. A model study under the FY-79 Demonstration Program is proposed to refine the type of ice control measure needed in this area.

At the lower end of Lake St. Clair, in the vicinity of Detroit, Michigan and Windsor, Ontario, an ice boom system is proposed to stabilize the natural ice which forms between the United States mainland, the channel islands and the Canadian mainland. The boom system is to maintain the natural ice arches which would be disturbed by passing vessels. The boom system would be constructed in three sections and would be located a few hundred feet upstream of the upstream end of Peach Island. A 1,500-foot section from the Canadian mainland to Peach Island, a 3,200-foot section from Peach Island to the navigation channel and a 1,200-foot section from the navigation channel to the United States mainland would be necessary. An opening approximately 500 feet would be left between the boom ends at the navigation channel to allow for vessel passage.

Dredging

No dredging is proposed for the St. Clair-Detroit connecting channel system except for icebreaker mooring facilities. Nothing in the plan describes what is to be done with the spoil generated. All dredging would be accomplished in a harbor where polluted spoil is present. The polluted spoil must be deposited in confined spoil areas.

Compensating Works

The compensating works will be designed to negate the effects of proposed ice booms at the head of the St. Clair and Detroit Rivers. The compensating works may cause adverse effects on the fish and wildlife resources of Lake Huron and produce serious consequences in Lake St. Clair and Lake Erie.

On the St. Clair River at Stag Island, river flow compensating works are proposed. Compensating works include a 2,500-foot training wall extending northerly from the northern end of Stag Island and a 400-foot gated structure extending from the Canadian mainland partially across the channel east of Stag Island. The training wall would be trapezoidal in cross-section with a random rockfill core and riprap outer covering. The gated structure would be equipped with buoyant flapgates. The gate supporting structures would be large cellular reinforced concrete sills with steel sheet pile cells at each end. The top elevation of the structures would be approximately 10 feet above low water datum (LWD = 574.7').

On the Detroit River at Peach Island, river flow compensating works are also proposed. The compensating works would be made up of two 1,500-foot training walls which would run parallel to the navigation channel, a 350-foot gated structure between the north training wall and the United States mainland, and a 700-foot gated structure from the south training wall partially across the channel toward Peach Island. The training walls would be trapezoidal in cross-section with a granular core, random rockfill outer mass, and riprap outer covering. The gated structure would be equipped with buoyant flapgates. The gate supporting structures would be cellular reinforced concrete sills with steel sheet pile cells at each end. The top elevation of the structures would be approximately 9 feet above low water datum (LWD = 571.3').

Shoreline Protection

Shoreline protection measures are proposed for the St. Clair River area. Further studies are underway to define areas of shoreline erosion and structure damage. The channel through the delta area is one of the areas being studied. Shore protection measures will probably be proposed later.

Island Transportation Assistance

The only transportation assistance proposed is icebreaker assistance for the island and cross-river ferries.

Connecting Channel Operational Plans

The operational plan calls for icebreaking as needed. Adverse effects are expected from this development in the shallow Lake St. Clair and in the St. Clair and Detroit Rivers.

Water Level Monitoring

This monitoring will be done in the connecting channel. There would be little effect on fish and wildlife resources.

Vessel Speed Control and Enforcement

The U. S. Coast Guard is responsible for the control and enforcement of vessel speed. The Coast Guard sees no need to lower speed limits because damages to shoreline are the responsibility of the vessel operator. Cause of damage is determined by the Coast Guard. Alternative means of shore protection are being studied.

Safety/Survival Requirements

These developments will not affect the fish and wildlife resources.

Vessel Operating and Design Criteria

These criteria have been developed to promote safe vessel operation in all United States waters. For vessels operating in ice, the criteria are explicit about hull strength, power plant size, strengthened steering mechanisms, special propellers, and other special gear. There also are special criteria for oil and hazardous substance transporters. Enforcement of these criteria will reduce the probability of accidents and spills. Vessels do and will continue to operate that are not in compliance with these needed safety measures. No additional regulations or enforcement are proposed.

Search and Rescue Requirements

These requirements will not affect fish and wildlife resources.

Oil/Hazardous Substance Contingency Plans

The Coast Guard is the responsible agency for these plans on the Great Lakes. These include one stockpile of materials located at Cleveland used to contain spills. A Regional Response Team also exists and the Service is a member. The cleanup of a spill is contracted to private companies.

Vessel Waste Discharge (Non-human) Requirements

These requirements and standards have been set and enforced by EPA. These requirements include the equivalent of secondary treatment. No wastes are to be discharged into the waters of the lakes. The problems of disposing of these wastes in special harbor facilities are being studied.

Environmental Plan of Action

The Fish and Wildlife Service and the Corps of Engineers have determined that much information is needed to make a precise evaluation of project effects. The EPOA is an attempt to acquire and evaluate the needed information and predict the effects of the project. The plan also provides for monitoring project developments. It will culminate in a report which will recommend ways to eliminate or minimize any adverse effects on the environment.

C. Fish and Wildlife

1. St. Clair River

a. Fish

(1) Without the Project

The 39-mile long St. Clair River is the upper portion of the St. Clair River/Lake St. Clair/ Detroit River Complex that carries the outflow of Lake Huron to Lake Erie. Very little is known about the ecological mechanism that is responsible for the fishery in the St. Clair Complex. Present knowledge indicates that the St. Clair Complex not only has a fishery of its own, but receives and contributes fish to both Lakes Huron and Erie.

The flow in the St. Clair River is mainly Lake Huron water, and therefore, water quality, as reflected in its benthic communities, is good. An exception to this is the poor water quality on the Canadian side near Sarnia where benthic communities are less diversified and dominated by more pollution tolerant organisms. In other areas of the river mayflies and caddisflies are well represented along with a wide diversity of oligochaetes, chironomids, snails and clams. The invertebrate population of the St. Clair River is found mainly outside of the shipping channel. An exception to this is the lower portion, particularly downstream of islands, where invertebrate communities extend completely across the river bottom. In addition to benthic communities, the flora of the river is also a very important part of the fish-producing mechanism. Aquatic vegetation is restricted to the area outside of the navigation channel as a result of bottom scouring by the propeller wash of commercial vessels. In the lower half of the delta area various pondweeds occur in abundance. Other rooted aquatic plants in the river and delta area include wild celery, common elodea, flexible naiad, coontail, muskgrass, hardstem bulrush, common threesquare bulrush, redhead grass, floating pondweed, leafy pondweed and sago pondweed.

Many of the fish species that can be found in this river move to or from Lakes Huron, St. Clair and Erie for spawning. Some of these species include walleye, muskellunge, rainbow trout, lake sturgeon, smelt, coho and chinook salmon, smallmouth bass, yellow perch, freshwater drum and channel catfish. Some species support populations elsewhere. For instance, some adult walleye, after spawning in the Thames River, a tributary to Lake St. Clair, move up to southern Lake Huron through the St. Clair River in late spring and return to Lake St. Clair in the fall. Furthermore, some of the Thames River walleye stock use the Detroit River and mix with Maumee River walleye stock that have migrated up from Lake Erie to the Detroit River. Walleye tagged along the south shore of western Lake Erie were later recaptured throughout the St. Clair complex and in southern Lake Huron. Some individuals are indigenous to the river. More work is needed to determine the extent of fish movement throughout the complex and the conditions that keep these movements intact. The Michigan Department of Natural Resources (MDNR) has also conducted stocking programs in the St. Clair complex. Since 1973, they have planted coho and chinook salmon in the Belle River, a tributary to the St. Clair River, the St. Clair River and Detroit River.

The locations of fish spawning and nursery areas in the St. Clair River has not been investigated

to a great extent. These areas are believed to be in the marshy and shallow bay areas, shorelines, on the rocky shoals of Stag and Fawn Islands and the three channels and wetlands of the delta area. Walleye and other species are believed to be spawning in the river and tributary streams. Most noteworthy is the relatively uncommon lake sturgeon which spawns in the North Channel of the Delta area.

Winter sport fishing in the St. Clair River occurs primarily in the North Channel area and Anchor Bay. In December, rainbow trout and walleye fishing activity downstream from the City of St. Clair begins to taper off because of unsafe boating conditions in the river. As soon as floating ice chunks are clear of the river in early spring the sport fishery begins again for the rainbow trout.

The longjaw cisco (Coregonus alpenae) which is on the Federal list of Endangered and Threatened Wildlife and Plants occurs in Lake Huron although its present status is not known. We have no reports of this species occurring in the St. Clair River System.

The quality of water is considered good in most areas of the St. Clair River and we can expect the waste discharges from Sarnia, Ontario to improve in the future. With the increase in the

water quality in this river, and also in the Detroit River, and with the increased effort by Michigan Department of Natural Resources to establish a salmon fishery in the St. Clair complex, we can expect an improvement in the overall quality of the fishery.

(2) With the Project

The following is a listing of various segments of the project with anticipated effects on the fishes of St. Clair River.

Icebreaking

Icebreaking will take place on the lower reaches of the St. Clair River. Effects are thought to be concentrated in near-shore areas. Sedimentation from propeller wash would smother and displace benthic organisms. Spawning areas may be degraded and fish eggs and larvae smothered by resuspended sediments. Fish would be exposed to turbulent currents causing additional stress. Loss of fishery resources would result from the above impacts. Noise caused by icebreaking and ice movement from commercial and icebreaking vessels will also add another disturbance in the aquatic environment. The short and long-term effects of all these distrubances is not known at this time.

Ice Control Structures

Ice booms are proposed in Lake Huron at the head of the St. Clair River. Ice booms do not appear to have significant effects on fishery resources. The anchors will be buried in the bottom and left in place. This could cause minor losses of habitat.

However, in the case of these specific ice booms, losses of fish and wildlife resources would occur in the areas downstream. The purpose of the booms is to reduce or eliminate ice jams downstream. This reduction of jams would affect water levels both upstream and downstream. The wetlands in Lake St. Clair and in Lake Erie would be affected most. These wetlands are important fish habitat used for spawning, feeding and cover. Because of shore erosion and structure damages expected in lakes St. Clair and Erie compensating works were proposed. These works would control the amount of flow to compensate for the differences in lake levels.

Compensating Works

The installation of compensating works for winter vessel traffic can alter the timing and range of normal water level fluctuations and result in serious damages to the valuable wetlands of Lake St. Clair and Lake Erie. Maintaining the

viability and the availability of wetlands to resident and migratory fish species requires that they undergo periodic inundation and drying. The mechanism that provides this process of rejuvenation is water level fluctuation. Decreasing the range of this fluctuation will destroy peripheral wetlands by not permitting them to be inundated. This will also eliminate spawning and nursery habitat. It is extremely important to have high water conditions in the spring of the year so that the nutrient rich, seasonally flooded wetlands are available for fish and migratory waterfowl. Water levels usually elevate again in the fall of the year and provide feeding areas for fish. Water level regulation, if not carefully planned, can be expected to degrade, or in some cases destroy the value of large portions of the wetlands in Lake St. Clair and western Lake Erie. This would subsequently reduce the populations of those species of fish and wildlife that are dependent on these wetlands.

The shoals of Stag Island, the proposed location of the compensating works, is one of two island areas in the river that may be valuable spawning habitat for walleye, smallmouth bass and forage species. The training wall is proposed on the upstream shoal of the island. Its construction would destroy most, if not all, of the spawning value of this shoal.

Shoreline Protection

The location or extent of shore protection measures in the delta area have not been supplied to the Fish and Wildlife Service. The delta is composed of large wetland areas. If the shore protection measures were to reduce or cut off the normal supply of water to these wetlands, their biological and hydrologic values would be degraded or destroyed.

Island Transportation Assistance

The described icebreaking assistance for the cross-river and island ferries is thought to have insignificant effect on the fisheries of the river. Some additional sedimentation from icebreaking might occur near the ferry slips.

Vessel Speed Control and Enforcement

This part of the plan could have a profound effect on the fishery resources of the river. Vessel speed is one of the factors controlling the pressure waves that can occur in confined channels. Several of these areas occur in the delta area. Excessive vessel speed has caused severe environmental damages in these parts of the system. Fishery resources have been eliminated directly and their habitat and food supply reduced. Without adequate vessel speed limits and enforcement at the above-mentioned critical area, fishery resources could be severely affected.

Vessel Operating and Design Criteria

Presently there are ships operating in the Great Lakes which do not have the modifications outlined in the Coast Guard's operating and design criteria. Fishery resources and human lives are imperiled because ships have not been modified to include the needed safety features. Strict requirements, incorporating these modifications for winter navigation, would reduce the chance of a major disaster.

Oil/Hazardous Substance Contingency Plans

The lack of compliance with the operating and design criteria causes the probability for a spill to increase. Existing contingency plans are untried in winter. Several of the described contingency plan segments do not adequately protect fishery resources. The National Strike Team response time of four hours is inadequate for a spill in the flowing waters of the connecting channels. A spill could travel a long distance downstream in that time. The containment booms have not performed satisfactorily even under more ideal conditions than found in winter. Response time for the regional teams is also too long. By the time cleanup equipment is on the site, the spill can extend downstream or downwind a considerable distance. Fish habitat could be

irreparably damaged. Fish eggs would be destroyed. Spawning habitat could be made unusable even if fish eggs are not present. A spill of heavier petroleum products will sink to the bottom smothering benthic organisms. These benthos are an important food source for fish. Existing capabilities do not appear adequate to prevent serious environmental damage.

A spill of oil, hazardous material or toxic substance in the St. Clair River will quickly be carried into the large ice-covered marshlands of the delta area. These marshlands and the ice-covered areas of the river would be impossible to clean up. The lake sturgeon spawning area in the North Channel would probably be destroyed for a number of years. Spawning areas of many other species in the delta area and Anchor Bay would also be eliminated.

Environmental Plan of Action

Much information concerning fishery resources needed to make a more detailed and accurate evaluation of project impacts. Accurate fish stock assessments, spawning area surveys and other baseline studies are needed. The EPOA will also provide for monitoring studies and will result in recommendations to eliminate or minimize adverse environmental impacts.

b. Wildlife

(1) Without the Project

The diverse habitat types of the St. Clair River area support a rich and diverse fauna. Over 60 species of mammals may be found in the basin, some of which are very important to man as game animals and furbearers. These include white-tail deer, eastern cottontail, raccoon, red and gray fox, beaver, river otter, mink and muskrat. Over 25 species of reptiles and 20 species of amphibians also may be seen. Over 250 species of birds have been observed in the St. Clair Basin.

The most valued wildlife habitat in the St. Clair River area, and for that matter, in the entire St. Clair complex between Lake Huron and Lake Erie, are the well-known St. Clair flats. These marshlands provide habitat for waterfowl and many other water-related species of wildlife. Lake St. Clair is an important spring and fall staging area for a large segment of the migrating diving and puddle ducks in eastern North America. The nutrient-rich beds of vegetation of Lake St. Clair and the marshes of the delta are important feeding areas for resident ducks as well. Some of the species using the area include the canvasback, redhead, mallard, black duck, baldpate, pintail, shoveller, bluewing teal, greenwing teal, ruddy duck, scaup, goldeneye and bufflehead.

The marshes also support a sizeable nesting population of ducks, coots, rails and other marsh birds, as well as muskrats, mink, raccoons, and other species of mammals. Other species using the marsh include the American egrets, great blue heron, American bittern, least bitterns, black-crowned night heron, little green heron, gallinules, pied-billed grebe, whistling swans and numerous song birds. The use of the marsh by the whistling swans, however, has dropped considerably in the last few years for reasons unknown. While some still use the area as a stop-over during their migration, the majority have begun to use the flooded corn fields near Wallaceburg, Ontario, which is located near the north-eastern edge of the delta marsh. In addition to the water associated wildlife, the ring-necked pheasant and eastern cottontail also use the marsh, especially as wintering habitat.

Federally listed endangered species which may be found in the St. Clair River Basin, are the American and Arctic peregrine falcon and Kirtland's warbler. The bald eagle has Federal threatened status in Michigan.

Portions of the St. Clair marshlands on the American side have been subjected to filling and development in the past 20 years. New awareness of the value

of wetlands by the general public and by regulatory agencies have produced policies and guidelines for wetland protection. Destruction of additional wetlands will be minimized.

(2) With the Project

Various operational measures considered necessary for extended season operation on the St. Clair River could produce changes in the environment which would ultimately affect wildlife of the lake year-round.

The following is a listing of the various segments of the project with anticipated effects on the wildlife of Lake Huron.

Icebreaking

Icebreaking will take place on the lower reaches of the St. Clair. Effects are concentrated in the shallow near-shore water. Propeller wash could cause currents which resuspend sediments and cause bottom scour displacing benthic communities used as food by wintering waterfowl and shorebirds. Icebreaking may also create open water areas which would attract and hold wintering birds.

Ice Control Structures

Ice booms are proposed in Lake Huron at the head of the St. Clair River. A small amount of open water may remain behind the booms. This may be attractive to waterfowl but will be over relatively deep water and, therefore, be used only for resting. The anchors will be buried in the bottom and left in place. This could cause minor losses of bottom habitat and benthos.

These particular ice booms would cause losses of wildlife habitat. The purpose of the booms is to reduce or eliminate ice jams downstream. This reduction in jams would affect water levels both upstream and downstream. The friction of the ice held back by the booms also will affect water levels. The wetlands in Lake St. Clair and in Lake Erie would be affected most. These wetlands are important fish and wildlife habitat used for feeding, breeding and cover by many species.

Compensating Works

Because shoreline erosion and structure damages would occur from effects of ice booms, water level compensating works have been proposed. These works will control the flows in the river, compensating for lake level changes.

If the natural range and duration of water level fluctuation were altered, the viability of the St. Clair delta and Lake Erie marshlands would be adversely affected. The periphery wetlands may not be inundated at the proper times for wildlife use. The nutritive value of the deeper areas would decrease because they may not undergo dry cycles. A decline in the distribution and abundance of resident wildlife species would be expected.

Shoreline Protection

The adverse effects to wildlife from shore protection measures depend largely upon the location and construction proposed. If the structures cut the flow of water between the river or lake and any of their contiguous wetlands, the value of the wetlands would be reduced. If these structures were located on valuable shoreline habitat, then the value of this habitat would be destroyed. Before actual impacts can be recognized from these structures more information on their location and design is necessary.

Vessel Speed Control and Enforcement

This development can have a profound effect on wildlife habitat within areas of pressure wave generation. The shoreline, wetlands and shallow

water areas are to be particularly vulnerable to this phenomenon. Vessel speed is one of the factors governing the generation of these pressure waves. The areas where these waves can be generated include the delta area of the St. Clair River. Excessive vessel speed has caused severe damages in other parts of the system. Wildlife habitat has been eliminated. Without vessel speed limits and enforcement at the above-mentioned critical area, wildlife habitat could be severely affected.

Vessel Operating and Design Criteria

As described in the fish section, there are ships presently operating in the Great Lakes which do not have the modifications outlined in the Coast Guard's operating and design criteria. Wildlife resources, especially waterfowl, are particularly vulnerable and imperiled because these ships are not modified and are subject to a higher probability of accident. Strict requirements, incorporating these modifications for winter navigation, would reduce the chance of a major disaster.

Oil/Hazardous Substance Contingency Plans

Existing contingency plans are untried in winter. Several of the described plan segments do not adequately protect wildlife resources, particularly waterfowl. The response times needed for the

National Strike Team and the regional teams are too long. By the time the equipment is on site, the spill could extend a long distance, especially when carried by strong currents or driven by winds. Heavier petroleum products will sink to the bottom smothering benthic food organisms. Vegetation emerging in spring could also be affected by a winter spill. In addition to long response times, some clean-up equipment is less than satisfactory. More effective equipment should be obtained and conveniently stockpiled throughout the basin.

Environmental Plan of Action

As was described in the fish section, the plan of action is designed to acquire information that will allow a detailed and accurate evaluation of project impacts.

c. Discussion

Possible impacts of extending the navigation season have been mentioned in a qualitative manner in previous sections. As stated much information is presently not available to make quantitative predictions of project effects on fish and wildlife populations and habitats.

The effects of the winter navigation program that need to be addressed are: (1) disturbances from vessel movement and resultant pressure waves, impacts on movement, abundance, species diversity and distribution of fish and benthic organisms in the river; (2) noise disturbance from ice breaking and ship movement through ice; (3) disturbances of vessel passage and icebreaking on the benthic community and on fish spawning and nursery areas; (4) alteration of normal water level fluctuations from the proposed ice booms and compensating works and their impact on the St. Clair and Lake Erie marshlands; (5) possible ice buildup in the North Channel and its impact on the fishery of the channel and in Anchor Bay; (6) impacts of the location and design of to be-proposed shore protection measures on fish and wildlife and on delta wetlands; (7) impacts of physical displacement of fish habitat from construction of the compensating works; and (8) the impact of a spill of oil, hazardous materials or toxic substances on fish and wildlife and their habitat.

Measures that would reduce the impact of winter navigation on the fish and wildlife resources of the St. Clair River area are:

(1) Prohibition of use by large displacement vessels in the connecting channels during the winter or reduce and enforce speed limits to reduce ship-induced pressure waves in the delta portion of the river. This will reduce destruction of bottom habitat outside the navigation channel. This action also will reduce the amount of bottom sediment that would be resuspended and distributed by propeller wash and river currents.

(2) Development and implementation of an environmentally sound pattern of flows that simulates natural bi-weekly maximum, median and minimum flows in the St. Clair River, water levels in Lake St. Clair, and water levels in Lake Erie to preserve the biological integrity of the St. Clair complex and Lake Erie wetlands. This should preserve the viability of wetlands and other shoreline habitats.

(3) Prohibition of the shipment of oil and other hazardous substances in the ice covered flowing waters of the connecting channels until an adequate spill contingency plan has been demonstrated. This contingency plan must have a short response time for sufficient containment and cleanup to assure protection of fish and wildlife. It must have provisions for strategic storage of adequate containment and cleanup equipment. The plan should provide for the adequate training of personnel in containment and cleanup techniques.

(4) Provision of a mechanism to require any ships navigating on the Great Lakes in winter to comply with existing operating and design criteria set forth by the Coast Guard. This would minimize the probability of accidents involving oil, hazardous materials or toxic substances and reduce the risk to fish and wildlife resources.

d. Recommendations

The Fish and Wildlife Service believes that, as presently proposed, this project will cause serious damage to the fauna and flora of the St. Clair River, the delta and Lake Erie marshlands.

The following recommendation supplements those listed previously in Section II. Great Lakes Basin, Part F.

(1) Prepare and implement an environmentally sound plan to simulate the natural biweekly maximum, median and minimum flows in the St. Clair River and the lake levels in St. Clair Lake and Lake Erie.

(2) Reduce vessel speed in the St. Clair River to the extent that no pressure wave-related adverse effects will occur to benthic communities and to the composition, abundance, and distribution of fishes. If this cannot be achieved by a reduction in speed, the use of large displacement vessels during winter months should be prohibited.

2. Lake St. Clair

a. Fish

(1) Without the Project

Lake St. Clair is an expansive shallow lake having shallow and marshy shores and a flatly sloping bottom formation. It is approximately 27,500 acres in size with a mean depth of about 10 feet and a maximum natural depth of about 20.5 feet. A 27.5 foot shipping channel has been excavated

across the lake. It extends from the mouth of the South Channel of the St. Clair River to the head of the Detroit River.

Burrowing mayfly larvae occur in the central, deeper mud-bottomed portion of Lake St. Clair. Midges and oligochaetes tend to be common in the shallow sandy areas near the shore.

The vegetation of the lake tends to be zoned. The shallow or shoreward zone, up to 7 feet, is composed characteristically of phragmites, cat-tail, bulrush, wildrice, arrowhead, burreed, knotweed, chiffa grass, spike rush, and rushes. The celebrated St. Clair Flats or delta is largely composed of this first zone of vegetation. The second zone, dominated by chara is from 7 to 20 feet deep, and includes the vast majority of the lake bottom.

Lake St. Clair is best noted for its muskellunge fishing although many other species such as the walleye, northern pike, channel catfish, small-mouth bass, largemouth bass, yellow perch, black crappie, white crappie, rock bass, white bass, bluegills and others are commonly caught. At times, chinook and coho salmon, rainbow and brown trout, lake whitefish, smelt and suckers also are caught. The lake is also host to a great variety of forage fishes and sea lamprey, gar, sturgeon and bowfin. In all, over 60 species have been identified.

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Some information is known about spawning areas in the lake. The Anchor Bay and delta marshes are the most active spawning areas for most species. It is believed that most of the lake population of the Great Lakes muskellunge spawn in the southwestern portion of Anchor Bay. Smallmouth bass also spawn in this vicinity. Largemouth bass, northern pike, channel catfish, yellow perch and black crappie spawn in most of the near shore waters of Anchor Bay between Mount Clemens and St. Johns Marsh. The area from St. Johns Marsh through the delta marshes provide important spawning habitat for northern pike, largemouth bass, smallmouth bass, crappies, bluegill and other sunfishes.

It is believed that most walleye in the St. Clair complex spawn in the Thames River, a Canadian tributary to Lake St. Clair. A tagging study in 1976 of the Thames River walleye stock found that after spawning in spring, some adult walleye moved from the Thames River through the St. Clair River and into southern Lake Huron. Then, in the fall or early spring, these fish returned to Lake St. Clair from Lake Huron. This same study found that tagged young-of-the-year walleye in Lake St. Clair tended to migrate down the Detroit River to western Lake Erie. In another investigation in 1963, tagged walleye from western Lake Erie were found to migrate throughout the St. Clair complex and into southern Lake Huron.

Walleye may not be the only species that move seasonally within and outside of the St. Clair system. The investigations conducted have shown the complexity of the fishery and emphasize the importance of protecting the St. Clair and Detroit Rivers from disturbances that disrupt fish movement.

Anchor Bay, and the many smaller bays in the delta region, are well known recreational ice fishing areas for northern pike, yellow perch, bluegill and other fish. Along the southern shore of the lake, between Belle River and Thames River, is a favorite ice fishing spot for walleye and yellow perch. Since 1970, no commercial fishing has been conducted in Lake St. Clair because excessively high mercury concentrations were found in the fish.

With enforcement of existing policies and regulations on wastewater discharges, offshore development and wetland destruction, the fishery value of Lake St. Clair is expected to increase. Recreational fishing pressure can be expected to in crease in the future. We can also assume that the commercial fishing may resume in the future.

(2) With the Project

The effects of vessel movement on fish in shallow water during winter are not completely known, but are believed to be significant.

The following is a listing of various segments of the project with anticipated effects on the fishes of Lake St. Clair.

Icebreaking

Discussion of this project segment is covered in Section VII. C.1.a.(2).

Ice Control Structures

Ice booms in St. Clair River could have a profound effect on the fishes of St. Clair Lake through impacts on the lake levels. A detailed discussion appears in the preceding section on the St. Clair River.

Compensating Works

A detailed discussion appears in the preceding section on the St. Clair River.

Vessel Speed Control and Enforcement

This part of the plan could have a profound effect on the fishery resources of the basin including all of Lake St. Clair. Vessel speed, displacement and channel cross-section are the factors which contribute to the pressure waves. These circumstances occur throughout Lake St. Clair. Ice fishing areas are located in various parts of the lake. The fishermen stay away from the vessel track because of the danger caused by passing ships and the resultant pressure waves. Excessive vessel speed has caused environmental damages in other parts of the system. Fishery resources and ice fishing have been eliminated. Without adequate speed limits and enforcement in Lake St. Clair, fishery resources could be severely affected.

Vessel Operating and Design Criteria

A detailed discussion appears in the preceding section on the St. Clair River.

Oil/Hazardous Substance Contingency Plans

A detailed discussion appears in the preceding section on the St. Clair River.

Environmental Plan of Action

A detailed discussion appears in the preceding section on the St. Clair River.

b. Wildlife

(1) Without the Project

The lake, delta and other areas of the Lake St. Clair watershed are used by many species of reptiles, amphibians, birds and mammals. Reptiles and amphibians include species of snakes, turtles, frogs, toads and salamanders. The wetlands, beaches, near-shore areas, quiet bays and the open lake are migration or nesting habitat for water-associated avians such as sandpipers, herons, bitterns, tern, snipes, gulls, swans, geese and ducks. There is a great blue heron rookery on Dickinsons Island in the delta area. The marshes and floodplain croplands also provide valuable habitat and support many species of songbirds.

Mammals in upland, beach and marsh areas include opossum, woodchuck, raccoon, skunk, weasel, mink, muskrat, fox, coyote and deer. Species listed on the Federal list of Endangered and Threatened Wildlife and Plants that may occur in the area include the bald eagle and the migrating peregrine falcon.

Lake St. Clair is used by migrating waterfowl as a staging area for the Mississippi and Atlantic Flyways. Extensive beds of submerged aquatic vegetation occur in this lake and are intensively used as forage by waterfowl. The delta marshlands

also provide nesting habitat for large numbers of these ducks and other birds. Hundreds of whistling swans use the Lake St. Clair drainage area as a migration route.

Enforcement of existing policies and regulations on shoreline development and wetland destruction can be expected to limit encroachment on existing habitat. Therefore, there should not be significant changes in species diversity or abundance due to limitations of habitat in Lake St. Clair. Limitations on migrating wildlife could occur anywhere along their migration routes.

(2) With the Project

The following is a listing of the various segments of the project with anticipated effects on the wildlife of Lake St. Clair.

Icebreaking

Icebreaking will take place only in the dredged channel of Lake St. Clair. The effects will be felt throughout the lake, particularly in the areas along the channel. A detailed discussion appears in the preceding section on the St. Clair River.

Ice Control Structures

Ice booms at the head of the St. Clair River could have a profound effect on the wildlife and their habitat of St. Clair Lake through impacts on lake levels. A detailed discussion of these structures appears in the preceding section on the St. Clair River.

Compensating Works

If the natural range and duration of water level fluctuations were altered, the viability of the shoreline and wetlands of Lake St. Clair, the St. Clair delta and Lake Erie would be adversely affected. The wetlands need periodic inundation and drying to furnish the food and cover necessary for wildlife. If these periodic water level fluctuations do not occur, wildlife populations will decline.

Vessel Speed Control and Enforcement

A detailed discussion of this project segment can be found in the St. Clair River section.

Vessel Operating and Design Criteria

A detailed discussion of this project segment can be found in the St. Clair River section.

Oil/Hazardous Substance Contingency Plans

A detailed discussion of this project segment can be found in the St. Mary River section.

Environmental Plan of Action

As was described in the fish section, the plan of action is designed to acquire information that will allow a detailed and accurate evaluation of project impacts.

c. Discussion

Possible impacts of extending the navigation season have been given in a qualitative manner in previous sections. As stated, much information is not presently available to make quantitative predictions of project effects on fish and wildlife populations and habitats.

Some of the effects that need to be addressed are vessel movement disturbances, water level manipulation and spills of oil, hazardous materials and toxic substances. Walleye and other species of fish move in and out of Lake St. Clair to the St. Clair and Detroit Rivers or to Lakes Huron and Erie. Vessel transit through the St. Clair and Detroit Rivers may have an effect on this movement and affect the fish populations in these areas. Vessel passage and resultant pressure waves in Lake St. Clair can have a devastating effect on fish resources and bottom flora and fauna. Water

level manipulation as a result of ice booms and compensating works may have an effect on water levels of Lake St. Clair and Lake Erie and, therefore, on fish and wildlife resources and habitats. Spills in the ice covered waters of Lake St. Clair could at best only be partially contained and removed before spreading. Complete cleanup may not be possible until late spring or early summer. By that time the spill may have been spread to a wide area by ship-induced pressure waves and lake currents and may have degraded or destroyed many acres of fish and wildlife habitat. There are measures that can be implemented to reduce or eliminate losses of fish and wildlife resources and their habitat.

A restriction on vessel displacement or a slower speed limit would reduce the adverse effects of pressure waves on the fish and wildlife habitat of Lake St. Clair. Water level manipulation to reproduce the historic biweekly maximum, median and minimum levels and flows will reduce adverse impacts on wetlands and fish and wildlife habitat. Damages as a result of spills from oil, hazardous materials, and toxic substances can be prevented by prohibiting the transportation of these environmentally dangerous cargoes through ice-covered waters until an environmentally acceptable spill contingency plan is devised. To be effective, the plan should provide for nearly immediate cleanup at the site, stockpiled materials necessary to contain and clean up spills, and personnel trained in techniques of oil containment and cleanup.

In addition to the contingency plan, a means should be devised to require ships navigating on the Great Lakes in winter to comply with existing operating and design criteria set forth by the Coast Guard. This would minimize the probability of accidents involving oil or hazardous substance spills, thus reducing the risk to the fish and wildlife resources.

d. Recommendations

Winter navigation through Lake St. Clair is expected to result in damages to fish, wildlife and their habitat. The extent of these damages is not presently known, basically because of two reasons. The first is that not enough is known about the biological resources of Lake St. Clair to fully understand what will be impacted. The second is that there is a lack of data on how widespread the effects will be from the various activities of winter navigation. Even with the lack of information in these two categories, there are some actions that can be taken to reduce or prevent the adverse environmental impacts of winter navigation.

The following recommendation supplements those listed previously for the Great Lakes Basin, Part F.

(1) Develop an environmentally sound plan for the St. Clair River compensating works to duplicate historic (without-the-project) bi-weekly maximum, median and minimum levels in St. Clair Lake.

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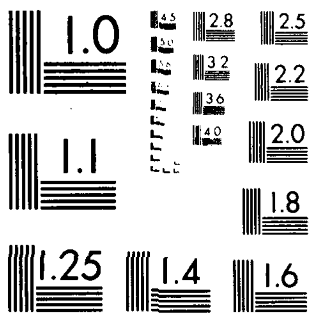

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3. Detroit River

a. Fish

(1) Without the Project

Human population growth and industrialization have altered both the physical, chemical, and biological characteristics of the Detroit River. Water quality of the 31-mile stream is substandard and has had a pronounced adverse impact on fishery resources. Although all reaches of the river have been adversely impacted, the lower 20 miles of the river from the junction of Rouge River to Lake Erie has been degraded most seriously. Mercury contamination has been one of the most serious problems. Poor water quality and inadequate public access has severely restricted public fishing. There is no commercial fishing activity in the river.

In recent years the water quality of the Detroit River has been gradually but steadily improving as a result of federal and state water pollution abatement laws and enforcement programs.

Fishery surveys and creel census information indicate that the river currently provides a limited sport fishery. Freshwater drum, channel catfish, yellow perch, walleye, rock bass and

smallmouth bass compose the bulk of the sport catch. In the spring, the downstream side of Peach Island provides good fishing for lake sturgeon. This may indicate a spawning area for these fish.

The Michigan Department of Natural Resources, since about 1973, has been conducting a stocking program in attempts to diversify the sport fishery. Species stocked include the coho and chinook salmon and the rainbow trout. Smallmouth bass have also been planted in the Belle Isle lakes. This stocking program is a part of a larger program being developed to provide more recreational fishing opportunities in the Metropolitan Detroit area.

The Detroit River fishery also includes migrating species. Walleye apparently move between western Lake Erie, Lake St. Clair and southern Lake Huron.

There are not believed to be any fish species inhabiting the Detroit River that are listed on the Federal list of endangered and threatened wildlife and plants. Historically, the blue pike and the longjaw cisco could have utilized the Detroit River and nearby Lake Erie.

It is assumed that the recent improvement in the water quality of the Detroit River will continue. This assumption is based on the strong national commitment to clean up the nation's waters as mandated by the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500) and related programs.

An improved aquatic environment in the Detroit River can be expected to have beneficial results on fishery resources and benthic communities. The most obvious changes in the river's fisheries will be in species composition. Larger percentages of game species such as walleye, yellow perch, bass and northern pike will occur and be reflected in the angler catch. Benthic communities are also expected to change. Pollution-tolerant organisms such as tubificids will be replaced by less pollution-tolerant invertebrates such as burrowing mayflies, caddisflies, amphipods and gastropods. The production of minnows and other forage fishes is also expected to increase substantially through improvements in the aquatic environment.

There is a good probability that current "homing" experiments being conducted by the Michigan Department of Natural Resources on rainbow trout, chinook and coho salmon, will prove successful and lead to establishment of major runs of these fish in

the Detroit River. Should these runs actually develop to the extent believed possible, the sport fishery of the Detroit River would be greatly improved.

(2) With the Project

The total effect of vessel movement on fish in the Detroit River during winter are not known.

The following is a listing of various segments of the project with anticipated effects on the fishes of the Detroit River.

Icebreaking Requirements

Discussion of this project segment is covered in Section VII. C.1.a.(2).

Icebreaker Mooring Improvements

A detailed discussion appears in the St. Clair River section.

Ice Control Structures

Ice booms are proposed at the head of the Detroit River at Peach Island. Ice booms do not appear to have significant effects on fishery resources. The anchors will be buried in the bottom and left in place. This could cause minor losses of habitat.

This ice boom, like the one at the head of the St. Clair River, can have a profound effect on fish and their habitat in western Lake Erie. The purpose is to reduce or eliminate ice jams downstream in the lower Detroit River. This reduction in jams would affect the water levels of Lake Erie and in Lake St. Clair. The wetlands and shoal areas in both lakes would be affected. These wetlands are important fish habitat used as spawning, feeding and nursery areas. Because of shore erosion and structure damage resulting from water level changes, compensating works were proposed.

Compensating Works

Construction of the compensating works at Peach Island on suspected spawning areas for lake sturgeon and other species will eliminate spawning on this site. A detailed discussion of compensating works is given in the St. Clair River section.

Dredging

Fishery resources of the Detroit River would be adversely affected by dredging of access channels for icebreaker mooring facilities. Spoil disposal could also have adverse effect. We are not aware of any additional dredging in the Detroit River at this time.

Vessel Speed Control and Enforcement

Winter ship movement can be expected to resuspend bottom sediments and disturb the aquatic environment as a result of ship-induced pressure waves. Peach Island's shoal and the lower island area area subject to these pressure waves. The bottom sediments that will be resuspended are likely to be polluted, especially in the harbors and the lower portion of the river. These sediments ultimately will be distributed downstream by water currents. The displaced sediments will most likely be deposited on and consequently degrade benthic communities, submerged aquatic plant communities and fish spawning areas. The Lower Detroit River contains extensive beds of aquatic vegetation in the vicinity of the Wyandotte National Wildlife Refuge and the downstream end of Grosse Isle and its associated islands. This also is an area where the pressure waves can be expected. Additional discussion of pressure waves is contained in the St. Clair River section on vessel speed control and enforcement.

Vessel Operating and Design Criteria

A detailed discussion appears in the St. Clair River section.

Oil/Hazardous Substance Contingency Plans

A detailed discussion appears in the St. Clair River section.

Environmental Plan of Action

A detailed discussion appears in the St. Clair River section.

b. Wildlife

(1) Without the Project

The Detroit River includes habitat that is important for many species of avian fauna. Most noted of these are shorebirds and waterfowl. Herring and ring-billed gulls, great blue herons, egrets, killdeer and spotted sandpipers are some of the waterbirds common to the area. Stony, Celeron, Grassy and Mud Islands serve as important shorebird habitat. Stony Island is also used as a heron rookery. The southern portion of Grassy Island has a rookery for gulls and terns.

Because of the industrial and urban nature of the area, little wildlife, other than waterbirds, are present.

The lower Detroit River, encompassing the Wyandotte National Wildlife Refuge, is a concentration area for waterfowl. During the spring and fall migration seasons mallards, black ducks, redheads, canvasbacks, goldeneyes, scaup and other species are attracted to the area by shoreline wetlands, beds of wild celery and other aquatic vegetation. This area has been a traditional staging area for canvasback populations. This portion of the river also has open waters in the early spring when surrounding lakes are still ice covered. These open waters, over aquatic vegetation beds, attract early migrants.

Because of heated effluents, navigation and currents, the Detroit River does not freeze during most winters. These open waters, plus aquatic vegetation beds and invertebrates, have also stimulated large numbers of canvasbacks, redheads and other diving ducks to winter in this area. Therefore, this reach of river is utilized by wintering and migrating waterfowl. To our knowledge there are no species of wildlife listed on the Federal list of endangered and threatened plants and animals that frequent the Detroit River project area.

With state and Federal efforts to abate discharges of polluted wastes into our nation's waters, we expect an improvement in the water quality of the Detroit River. Some improvements have already

occurred. As water quality increases, the distribution and abundance of fresh water snails, fingernail clams and mayfly larvae should also increase. These are important food items of diving ducks along with vegetative foods such as wild celery, pondweeds, waterweed and others. An improvement in the quality of water itself will remove health hazards to migrating and nesting waterfowl and shorebirds. Water quality improvements also mean reducing thermal loads and the amount of open water areas. This would be beneficial in that a smaller number of waterfowl would winter in the Detroit River and force migration to more desirable southern wintering areas. As a result of water quality improvements, we expect increased numbers of migrating waterfowl and shorebirds using the lower Detroit River as stopover and nesting areas.

(2) With the Project

Various operational measures considered necessary for extended season operation on the Detroit River could produce changes in the environment which would ultimately affect wildlife of the area year-round.

The following is a listing of the various segments of the project with anticipated effects on the wildlife of the Detroit River.

Icebreaking

Icebreaking will take place at the extremities of the river. The middle portions of the river remain ice free most years. The effects are concentrated in the shallow near-shore waters where the track is in a dredged channel. Propeller wash causes currents which resuspend sediments and cause bottom scour. This would degrade or destroy benthos and vegetation used as food by wintering waterfowl.

Icebreaker Mooring Improvements

These improvements involve the use of shorelands for storage facilities and pier space. An access channel between the pier and the navigation channel may be needed. The project plan does not give enough detail to determine what resources may be affected in Detroit Harbor. Harbor bottoms are highly polluted. If dredging of these polluted bottoms occurs spoil would have to be confined.

Ice Control Structures

A detailed discussion appears in the St. Clair River section.

Compensating Works

A detailed discussion appears in the St. Clair River section.

Vessel Speed Control and Enforcement

A detailed discussion appears in the St. Clair River Section.

Vessel Operating and Design Criteria

A detailed discussion appears in the St. Clair River section.

Oil/Hazardous Substance Contingency Plans

A detailed discussion appears in the St. Clair River section.

Environmental Plan of Action

As was described in the fish section, the plan of action is designed to acquire information that will allow a detailed and accurate evaluation of project impacts.

c. Discussion

Possible impacts of extending the navigation season have been mentioned in a qualitative manner in previous sections. As stated, much information is presently not available to make quantitative predictions of project effects on fish and wildlife populations and habitats. A detailed discussion of project impacts appears in the St. Clair River section.

Measures necessary to reduce or prevent some of the adverse effects of winter navigation in the Detroit River are:

(1) Reduction of the speed limit of vessels in the river or, if necessary, prohibition of the use of large displacement vessels. This will reduce ship induced pressure waves and associated bottom disturbances. A reduction in these disturbances would reduce adverse effects on the species composition, population size, distribution, spawning habitat and movement activities of fish in the Detroit River. A reduction in bottom disturbance would also reduce the size of unstable bottom. These areas prevent the establishment of diverse benthic and vegetation communities. As water quality improves, this reduction of ship induced bottom disturbances also could allow the re-establishment of more diverse benthic and vegetation communities in areas where these communities are now seriously degraded by poor water quality.

(2) Termination of the shipment of oil, hazardous materials and toxic substances during the winter months until an environmentally acceptable spill contingency plan is devised. Thousands of diving ducks, primarily canvasback, redhead and scaup, winter in the lower Detroit River. During this time of the year the waterfowl are at their weakest physical condition and are unable to fly great

distances. There are almost no other open water areas in the locality of the Detroit River that the birds could be hazed to if a spill did occur. Furthermore, the winter supply of forage will probably be greatly reduced or destroyed, causing massive starvation. The waterfowl, therefore, are extremely vulnerable to any winter spills on the river. Transportation of oil, hazardous materials and toxic substances should be terminated until an environmentally acceptable contingency plan protecting waterfowl, fish, spawning areas and forage organisms is devised.

After environmentally effective spill response capability has been demonstrated, a way to further minimize the probability of accidental spills is to require ships navigating on the Great Lakes to comply with existing operating and design criteria. This would minimize the probability of accidents involving oil or hazardous substance spills, thus reducing the risk to the fish and wildlife resources.

(3) Development and implementation of an environmentally acceptable plan for operating the compensating works to reproduce the natural bi-weekly maximum, median and minimum flows in the Detroit River and the water levels in western Lake Erie. Even if the presently proposed compensating works could duplicate the natural levels and flows, its design and location at Peach Island requires further

study to insure that it will not adversely affect the habitat of scarce lake sturgeon or other important species.

d. Recommendations

The following recommendations supplement those listed previously for the Great Lakes Basin, Part F.

(1) Reduce vessel speed in the Detroit River to the extent that no pressure wave-related adverse effects will occur to benthic communities and to the composition, abundance and distribution of fishes. If this cannot be achieved by a reduction in speed, the use of large displacement vessels during winter months should be prohibited.

(2) Prepare and implement an environmentally sound plan to simulate the natural biweekly maximum, median, and minimum flows in the St. Clair River and the lake levels in Lake St. Clair and Lake Erie.

7. Summary

The St. Clair River-Lake St. Clair-Detroit River connecting channel is of very high value to fish and wildlife resources even though parts of the system have been degraded in the past. The fish and wildlife in the area are of surprisingly high value when the highly industrialized and urbanized nature of the area

is considered. The trophy fishery for muskellunge, the high value walleye and perch fishery, the presence of the scarce lake sturgeon, the walleye recruitment from Lake St. Clair to Lakes Erie and Huron, high canvasback and redhead use, and high ice fishing use in some areas, all point to the fact that this connecting channel system is of paramount importance. It demands the utmost consideration when planning future developments.

The Navigation Season Extension Survey Study proposals would be damaging to the fish and wildlife resources of the connecting channel system. It is not known to what extent because the quantity of the resources has not been identified nor the total impacts of the project on them. However, enough is presently known that recommendations can be made to eliminate or minimize the known adverse effects on the fish and wildlife resources. Studies to quantify the resources and to determine impacts are to be undertaken within the EPOA framework as described in the Survey Report. Meanwhile, the proposals for the St. Clair-Detroit connecting channel should not be authorized unless the previously listed recommendations are included and the means and measures necessary to implement them are described.

VIII. LAKE HURON HARBORS

A. Calcite Harbor

1. Description of Area

Calcite Harbor is located in the northeast area of the lower Michigan peninsula.

In a number of Lake Huron's nearshore areas, particularly within harbors and at the mouth of streams, water quality is lower than in Lake Huron proper. Calcite Harbor is such an area. It receives waste loads from tributaries, municipal treatment plants, and small industries. U.S. Steel Dolomite Plant, the largest limestone quarry in the world, has its own power generating station which discharges heated effluent into the Calcite Harbor area. Water quality within the harbor is also affected by vessel passage.

2. Description of Project

Winter shipping in Calcite Harbor would require the installation of a 1,000-foot bubbler system and the use of an icebreaking tug. (Figure VIII-A-2-1) An existing bubbler system is currently used within the ship's winter mooring area. It is periodically used to maintain thin ice condition between the anchored ships.

Commercial vessels may need an icebreaker escort when shifting ice fields pile up on the shore area.

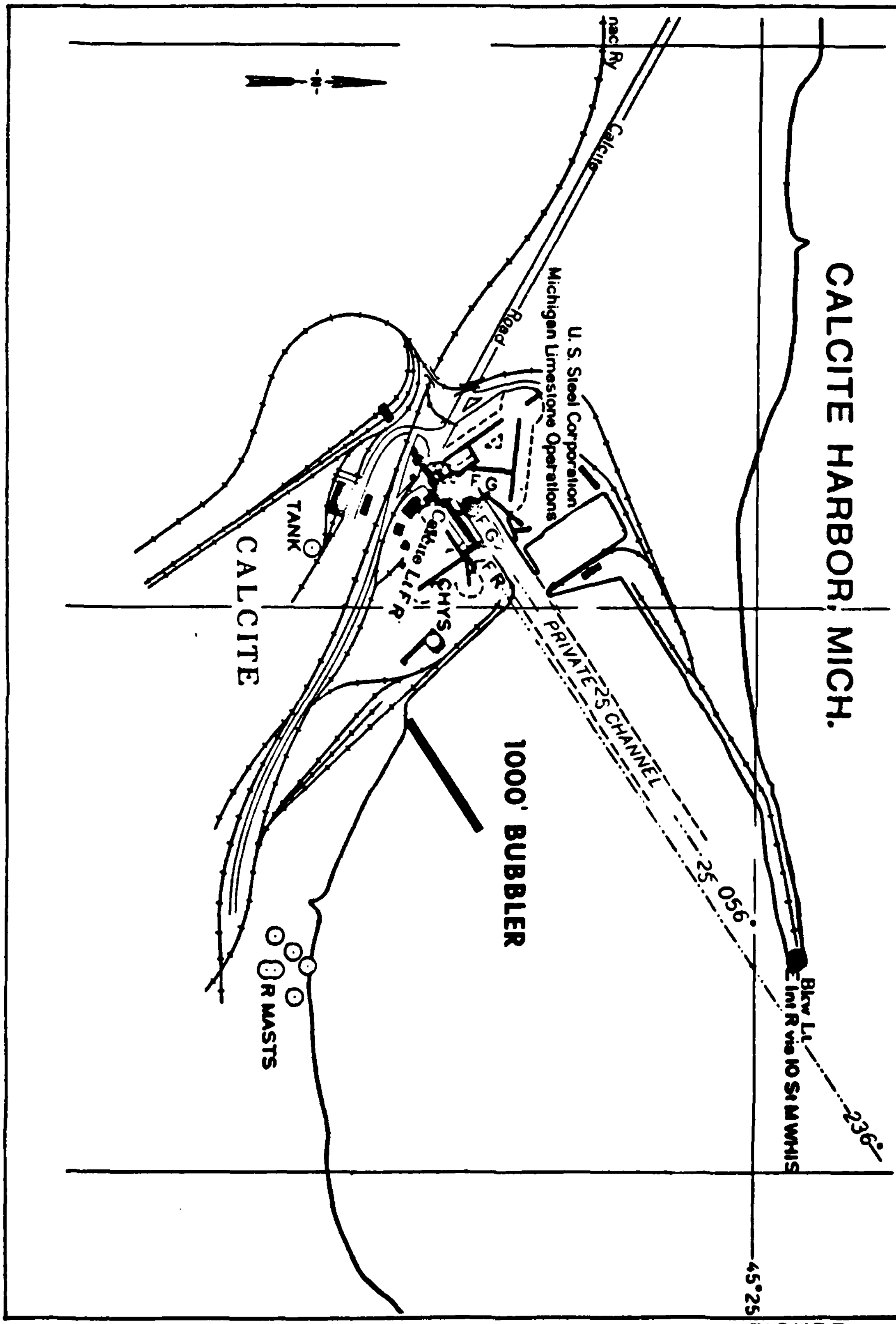


FIGURE VIII-A-2-1

3. Fish

a. Without the Project

No winter-specific fishery data is available concerning species composition within the harbor. The Michigan Department of Natural Resources has used the harbor area for the planting of lake trout and splake.

Recent field investigations produced eight species of fish: lake trout, splake, rainbow trout (steelhead), round whitefish, gizzard shad, rock bass, white sucker and slimy sculpins. Perch, lake whitefish, salmon, northern pike, smallmouth bass, brown trout, and walleye are caught within the harbor during ice-free periods. Crayfish and forage fish species are also reported to be present.

Large concentrations of splake and lake trout are in the harbor during October and receive heavy fishing pressure. It can be presumed that these mature fish are attempting to spawn along the shoreline and breakwall areas of the harbor. Round whitefish are also caught in numbers along the shoreline area indicating they may also be using the harbor location for spawning. A breakwall located near the harbor appears to be an excellent area for such spawning activity. Eggs of these fish usually overwinter and hatch the following spring.

Large spawning runs of northern pike have taken place in streams along the shore southeast of the harbor. Winter fishing occurs for these fish. Little ice fishing

is attempted on the lake proper because of unstable ice conditions. Overland access to the harbor area is controlled by the Calcite Plant; therefore, pier and shoreline fishing pressure is minimal.

Without winter shipping, species composition and habitat utilization could be expected to remain unchanged unless the Department of Natural Resources should alter its fish management programs.

The boat-based sport fishery will continue to increase due to the excellent results being achieved by boaters utilizing Calcite Harbor. There is no commercial fishing in the area. No Federally listed threatened or endangered fish species are known to inhabit or frequent the harbor.

b. With the Project

The effects of the bubbler system proposed for the harbor are not known, but should be insignificant. Ship movement in and out of the harbor will resuspend sediment that will be deposited in or adjacent to the channel and would be detrimental to any fall fish spawning activities that might be taking place there.

If ice stabilization structures were constructed in waters adjacent to the harbor area, ice fishing activities would be enhanced substantially by the removal of fear of ice movements.

4. Wildlife

a. Without the Project

Wildlife which inhabit the area are red and fox squirrels, eastern cottontail, white-tail deer, red fox, muskrat, mink, bobcat, coyote, snowshoe hare, and numerous small mammal species.

Plovers, terns, gull, and sandpipers frequent the break-wall and shoreline areas during the spring, summer and fall periods.

Many waterfowl species utilize the open waters of the harbor during migration, breeding and nesting seasons. Included among those species are: black duck, ringneck duck, lesser scaup, greater scaup, redhead, canvasback, goldeneye, mergansers, snowgoose, blue goose, Canada goose, old squaw, whistling swans and loons. Waterfowl occasionally utilize the open water areas of the harbor during the winter months depending on ice conditions.

Birds of prey, such as snowy and great-horned owls, utilize the shoreline area for feeding grounds during winter. In the open water periods, eagles and osprey could utilize the area. A bald eagle nesting site is located 17 miles south of the harbor, and an osprey nest site is located on the Calcite Plant property. The osprey is on the state threatened species list.

No information was available on hunting activities within the harbor or adjacent area.

With the continuation of present management practices, wildlife populations should maintain themselves within their normal cyclic trends, and in numbers that correspond to available habitat quality and diversity. No forthcoming adverse changes in habitat are apparent, but industrial expansion could alter habitat quality and quantity.

b. With the Project

The effects of winter navigation on resident wildlife is unknown at the present time due to lack of sufficient data. If bubbler operation creates new open water, waterfowl could be attracted to these areas.

5. Discussion

Fall and winter data concerning the spawning, species composition, distribution, and food base of Calcite Harbor fishes are virtually non-existent. This lack of information precludes all but the most cursory analysis of the effects of winter navigation on the harbor's winter fishery. Baseline studies, with emphasis on the identification of spawning and feeding areas, should be initiated prior to project authorization.

If studies indicate that the breakwater area is a valuable spawning area, project authorization should include funds for the construction of an artificial reef. This reef would replace lost spawning habitat and should be located in an area unaffected by channel siltation problems. The Service would be pleased to assist the Corps of Engineers in the design and location of the structure.

A potentially serious impact resulting from sustained operation of bubbler systems could be the encouraging of waterfowl to use the open water areas for winter residence. Waterfowl die-offs could result if bubblers were shut down for extended periods of time during cold weather. An operational schedule should be developed to minimize the size and duration of these areas.

6. Recommendations

The following recommendations supplement those listed previously for the Great Lakes Basin, Part F.

(1) Construct an artificial reef to replace spawning habitat lost as a result of the removal of Calcite Harbor's breakwater.

(2) Develop a bubbler operation schedule which would minimize the size and duration of open water areas.

B. Alpena Harbor

1. Description of Area

Alpena, Michigan, population 15,000, is the largest community in the sparsely populated Thunder Bay River Basin of Western Lake Huron (Figure VIII-B-1-1). A major port on Lake Huron, Alpena is the site of the world's largest cement manufacturing center. Draining an area of 1,269 square miles, the Thunder Bay River flows into Lake Huron at Alpena. Principal tributaries to the Thunder Bay River are the North Branch, South Branch, and Lower South Branch.

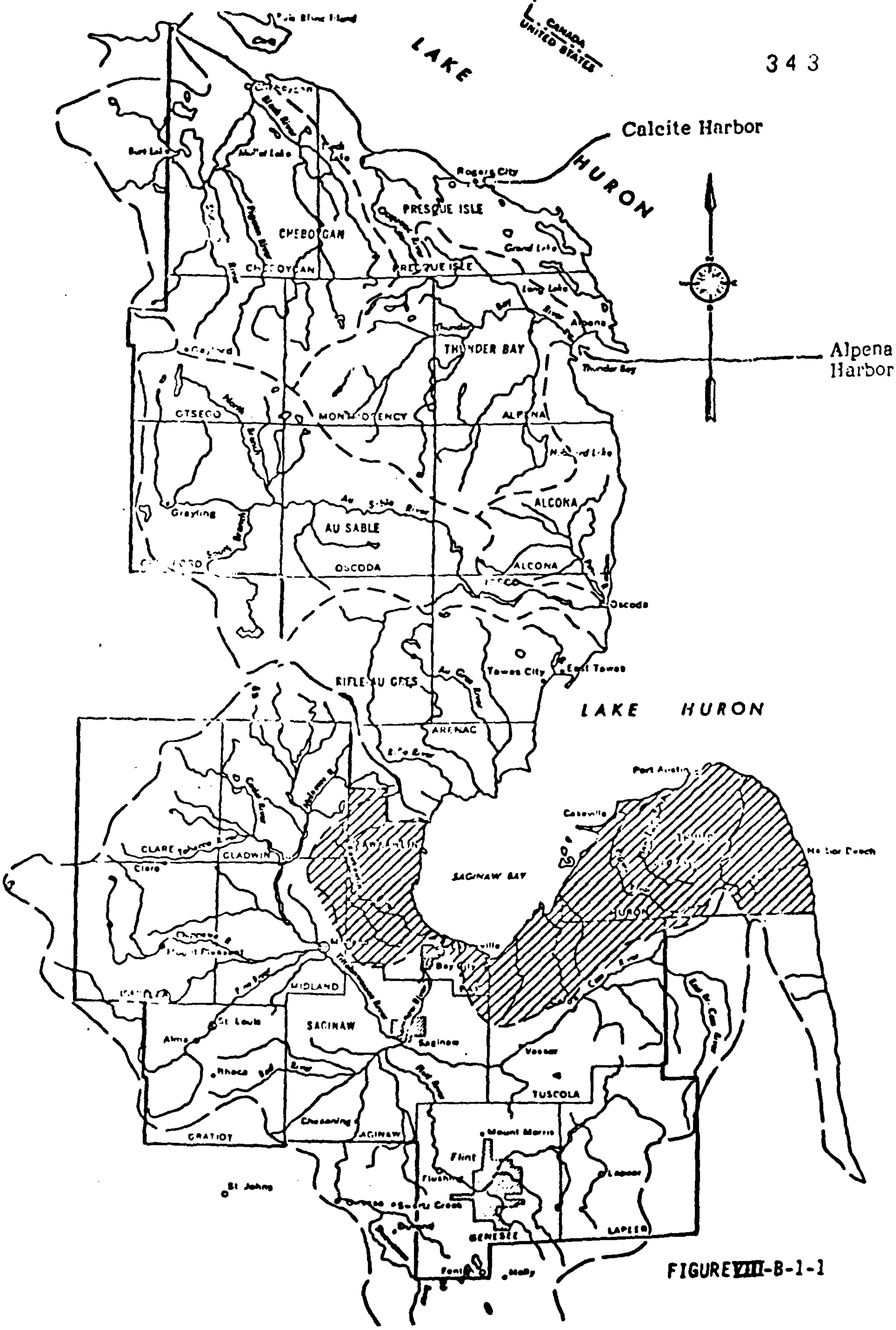


FIGURE VIII-B-1-1

Water quality is generally good throughout the basin although two reaches have substandard water quality. One reach near the mouth of the river in the Alpena area, receives one municipal and two industrial discharges. It exhibits lowered dissolved oxygen concentrations and elevated levels of coliforms, nutrients, suspended solids, and dissolved solids. Benthos near the river mouth have been eliminated due to waste discharge and dredging operations. The second reach with poor water quality is located many miles upstream and is localized.

2. Description of Project

Vessel movement in and out of Alpena Harbor will require the assistance of an icebreaker in Thunder Bay. The installation of two 1,000-foot bubblers within the river harbor is also proposed as is the installation of two fixed all-weather navigation lights.

3. Fish

a. Without the Project

Main forage species of the bay area include smelt, alewife, spottail shiner, and Johnny darter. Lake trout may spawn during late fall in the Thunder Bay River and Thunder Bay. Exact spawning locations for lake trout have not been determined. The first full-scale spawning attempt in the area was expected in the fall of 1978, as all the original planted female trout will be fully mature. Lake whitefish spawning activity takes place in the North Point area and is thought to be among the more successful in Lake Huron.

With Thunder Bay being relatively shallow, open water perch fishing is good. Other intensive open water sport fishing activities are also carried out for lake trout, brown trout, smallmouth bass, northern pike, and whitefish. Walleye are also reported in the area, but in numbers too low to support a viable sport fishery.

The winter fishery is presently restricted to nearshore sheltered locations along the shoreline and in the warm water outflow from the Huron cement plant. General ice conditions are too unstable to promote full-scale ice fishing activities. Fishermen now pull small boats out with them during winter ice fishing trips.

Future plans for the Thunder Bay area involve increased stocking of additional brown trout, steelhead, lake trout, and other species.

Fishing pressure within the Thunder Bay area will increase due to population growth in the Saginaw Bay/Tri City area. An extensive winter fishery for perch, brown trout, and lake trout could be developed if stable ice conditions were present.

The management and winter sport fishery potential for Thunder Bay would be enhanced if ice stabilization structures were constructed in the offshore area of the Bay. A good perch fishery exists at present and an excellent lake trout fishery is in the offing.

There is no commercial fishery in Thunder Bay. As no statewide biological surveys have been conducted

in Michigan since 1921 for species status, little information is available on the possible status of any endangered or threatened species of aquatic organisms. No Federally listed endangered or threatened fish species are presently known to be residing in the area.

b. With the Project

If year-around navigation is promoted within Thunder Bay, some disruption of spawning activity and success could develop. However, the present species composition of the harbor and bay area would probably not change as a direct result of winter navigation.

4. Wildlife

a. Without the Project

Thunder Bay (Figure VIII-B-4-a-1) is an important waterfowl concentration site. Its tributary river system in Montmorency and Alpena Counties supports an estimated annual 365,000 waterfowl use-days. Waterfowl inventories conducted in early January for the past several years from Saginaw Bay to Cheboygan found goldeneye, mergansers and oldsquaw utilizing the western shoreline during the winter months.

The Alpena City area supports a wintering population of 200 Canada geese and 500 mallards. Mallards, goldeneye, and mergansers are commonly found on the open water areas of the Thunder Bay River below the dam site.

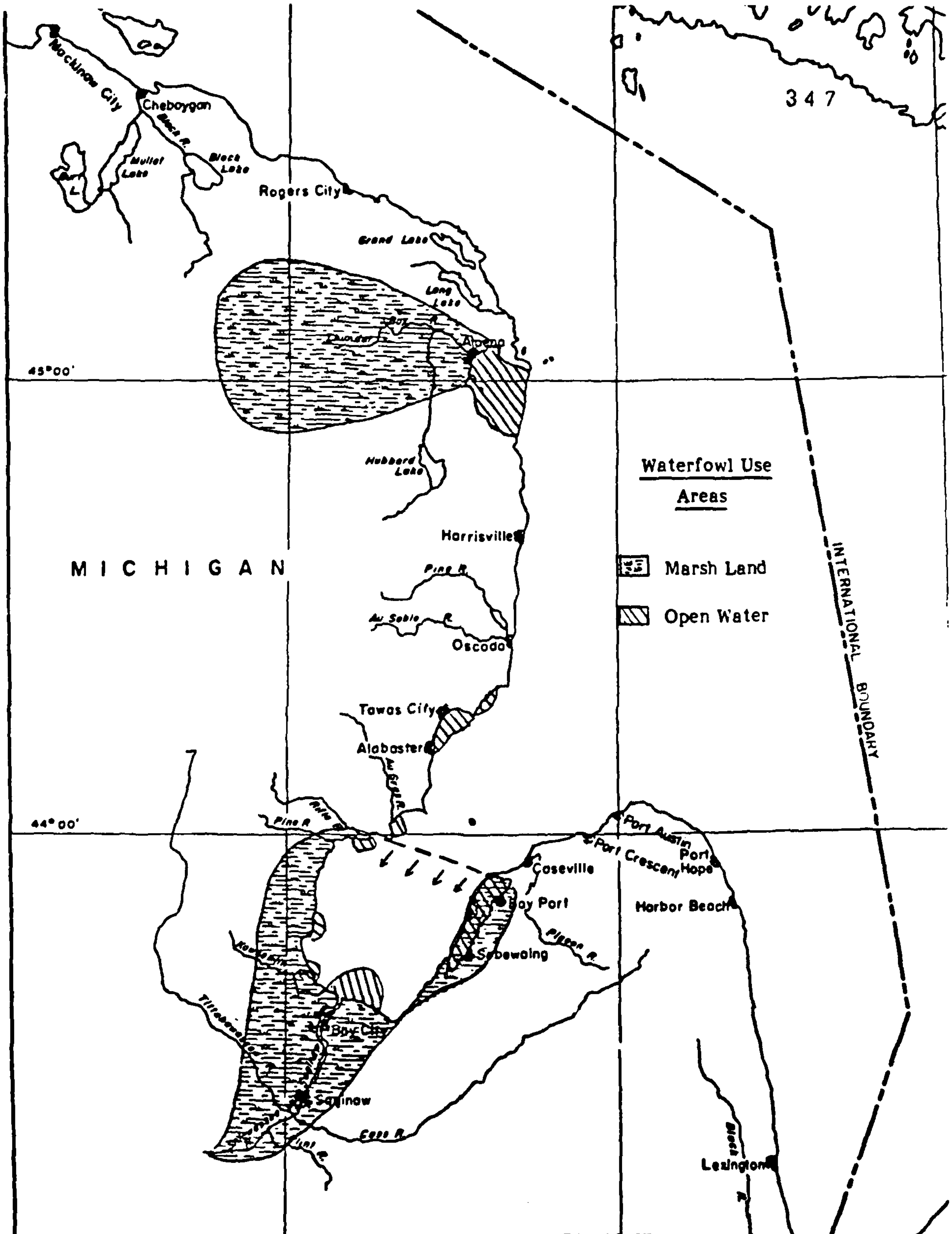


FIGURE VIII-B-4-a-1

Inland lakes and marsh areas are presently being developed and managed for waterfowl and goose production. With the large concentrations of waterfowl utilizing the bay area, future refinements in management practices may be employed to enhance the area.

Many songbirds and shorebird species inhabit the breakwall, river shoreline and bay area during the warmer weather, with the hardier species remaining throughout the winter.

Furbearing mammals, such as muskrat, fox, mink, and raccoon, live along the river and bay areas. Other small mammals and birds such as mice, flying squirrels, chipmunk, snowshoe hare, red squirrels, fox squirrels, ruffed grouse, woodcock, and numerous songbirds are found in the upland habitat locations.

The Federally listed endangered Arctic peregrine falcon may pass through the Thunder Bay area on its spring and fall migrations. The bald eagle nests in the immediate vicinity. Three eagle nesting locations are within five miles of the harbor, with one nest located on an island in Thunder Bay. Six eagle nesting sites are known to exist within 20 miles of the harbor.

b. With the Project

The initiation of winter navigation should have minimal effect on the wildlife of the area. It is not known whether winter shipping will produce adverse impacts on bald eagles.

5. Discussion

At the present time, winter sport fishing in Thunder Bay is difficult because of naturally unstable ice conditions. That situation can be expected to worsen with increased winter vessel traffic. The development of ice stabilization structures at strategic locations would enhance winter fishing in the bay and provide recreational opportunities near a large metropolitan area. Such structures may also prevent ice jams at the harbor entrance during southeast winds.

Bald eagle nesting activity in Thunder Bay should be closely examined prior to project authorization.

6. Recommendations

The following recommendations supplement those listed previously for the Great Lakes Basin, Part F.

(1) Develop ice stabilization structures to provide winter fishing opportunities.

(2) Investigate winter use of Thunder Bay by bald eagles.

C. Saginaw Bay

1. Description of Area

Saginaw Bay is a shallow indentation of the western shore of Lake Huron (Figure VIII-C-1-1). The bay is 26 miles wide at its mouth and approximately 51 miles long. The bay is divided into an inner and outer portion by a constriction

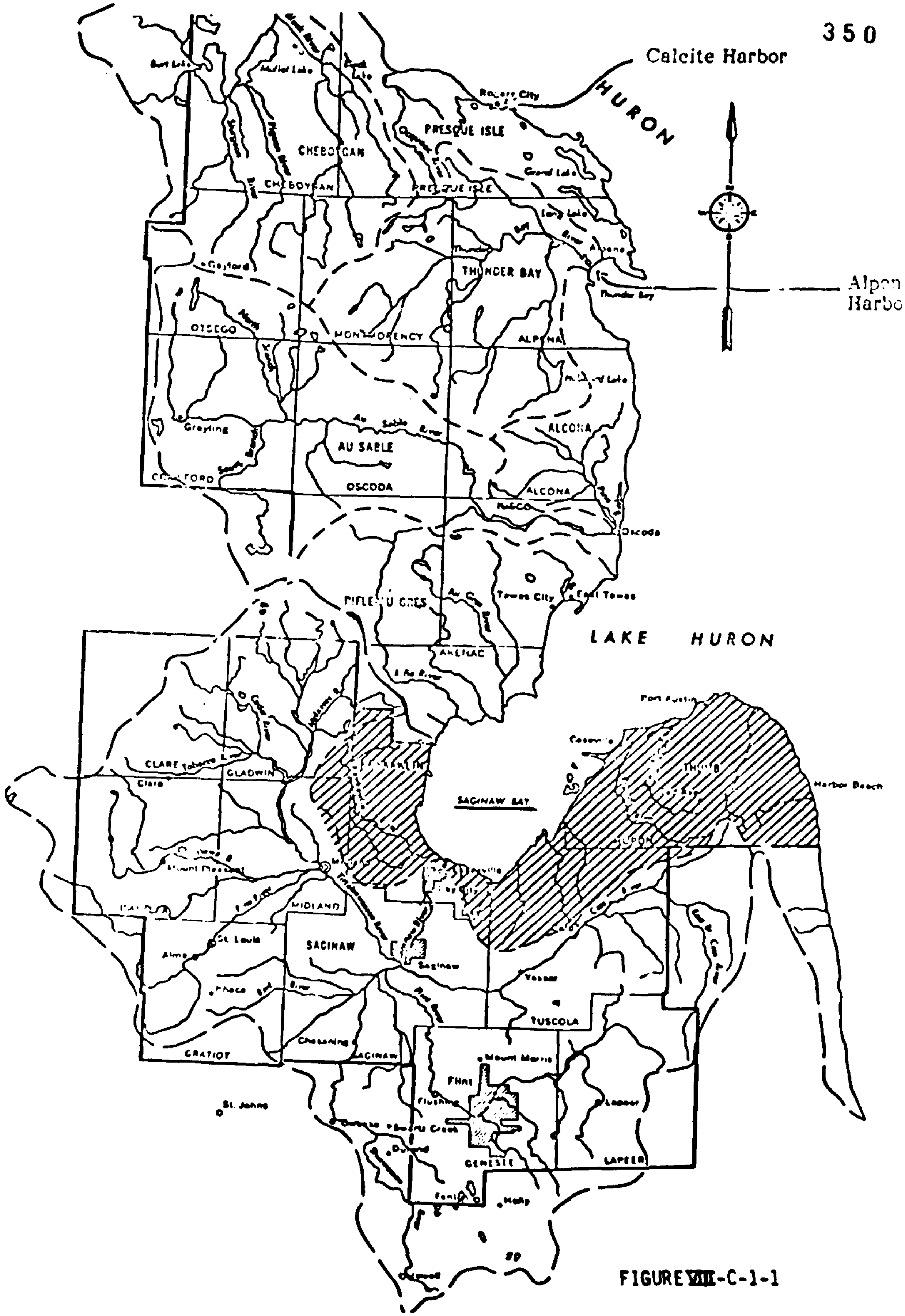


FIGURE VIII-C-1-1

reducing its width to 13 miles at the midpoint. The outer bay has a mean depth of 48 feet, a maximum depth of 133 feet, and is limnologically similar to other parts of Lake Huron. The inner bay has a mean depth of 15 feet and a maximum depth of 46 feet. This area is eutrophic and limnologically comparable to the western basin of Lake Erie.

The shores of the inner bay vary from marsh to low, sandy ridges. The majority of sediments are composed of sand, gravel and silt which are shifted about by currents. Only the shipping channel contains high quantities of mud and silt originating from the river.

The east shore of the outer zone is rocky, while the west shore has extensive sandy areas with some rock and clay outcrops occurring near Point Lookout. The shoal around Charity Island and most of the points in the outer zone are rocky. Tawas Point and Sand Point are sand spits. The inner zone has extensive shallows. A broad, sandy flat extends southward from Wildfowl Bay. Another irregular sandy flat extends from the Saginaw River along the west shore to Point AuGres. Several shallow spits off the mouths of small rivers extend over this flat perpendicular to the shore. The two large flats have extensive marshes near shore.

The bay has several islands, the most prominent of which is Charity Island. A group of marshy low-lying islands are located southwest of Sand Point. These islands are surrounded by marsh shallows for which there is no clear line of demarcation.

The waters of Saginaw Bay differ from those of the main body of Lake Huron. Saginaw Bay waters exhibit higher concen-

trations of calcium, sodium, potassium, chlorides, and sulfates. They are also harder, warmer and more turbid.

The water quality of Saginaw Bay, which reflects the abundance of waste materials from the Saginaw River and other small tributaries has been adequate to support all but a few designated uses. The waters of the inner bay exhibit nutrient levels which support extensive algal blooms. The Saginaw River, the principal influence on water quality in the bay, discharges large quantities of pollutants from industrial, municipal and agricultural sources into the bay.

The Saginaw River has substandard quality throughout its entire length. Tributaries contribute sizeable waste loads, especially chlorides and nutrients. Pollutants are present in high concentrations throughout the year and dissolved oxygen levels are low downstream from Bay City and Saginaw. The river carries a high suspended sediment load causing extensive sediment deposits in the bay.

Several cattail marshes used primarily by dabbling ducks are located along the western coast of the bay, from Point AuGres south to Bay City. This part of the bay freezes over in winter. Wigwam Bay Wildlife Area, Nayanquing Point WA and Tobico Marsh State Game Area, located along this stretch of shoreline, are managed for waterfowl by the Michigan Department of Natural Resources.

2. Description of Project

The ship movement problems associated with winter navigation in Saginaw Bay are considered to be minor in nature because

of the relatively thin ice cover that normally exists. Specific problems listed are vessel movement through rafted ice and windrows in the outer bay and the lack of all-weather navigational aids.

Recommended solutions to the ice problems include the use of a commercial icebreaking tug in Saginaw Harbor and the use of a Coast Guard Type C icebreaker in Saginaw Bay. The Coast Guard (CG) icebreaker would require the development of adequate mooring space at the present CG station in Bay City. This space includes onshore storage space, a mooring space, and an access channel to the pier.

Proposed solutions to the deficiencies in all-weather navigation in the bay include the installation of an ice navigation center, a mini Loran C unit with radar transponders and two fixed navigation lights.

The potential exists for the ice field to shift at the river mouth when icebreaking action takes place. To alleviate this problem, a 10,000-foot ice boom has been designed and proposed that would be attached to Gull Island and extend parallel to the north side of the channel in the bay.

3. Fish

a. Without the Project

Saginaw Bay's "estuary"-like habitat makes it an extremely important spawning and nursery area for many Lake Huron fish species. The introduction of coho, chinook salmon, and lake trout into the Saginaw Bay area has brought

new interest in sport fishing, which previously had centered on smallmouth bass, northern pike, yellow perch, suckers, and rainbow smelt. The fishing season is year-round and in 1970 the total fishing pressure was 264,000 angler days. A large ice fishery extends along both sides of the bay for yellow perch, channel catfish, suckers, and lake trout. This ice fishery has consisted of about 16,700 angler days on the west side of the bay from January to April and about 1,200 angler days on the east side during the month of January 1976 alone. Winter sport fishing pressure is expected to increase.

One thousand walleye fingerlings were stocked within the bay in 1978. As the walleye mature, they will inhabit the deeper water areas. Sport fishing pressure is expected to extend into areas in which it is not now present throughout the winter.

There are eight commercial fishermen operating mainly on inner Saginaw Bay. The primary gear used is trap nets and large mesh gill nets. The principal fish species taken commercially include carp, yellow perch, bullheads, and catfish. The harvest for gill nets and trap nets fished under the ice on the west side of the bay in 1976-77 are as follows:

Perch	31,364 lbs.
Carp	133,797 lbs.
Bullheads, catfish	2,220 lbs.

Summer and winter commercial fishing pressure has been steady to increasing. Fishing pressure fluctuations can usually be traced to a change in year class strength in the major harvested fish population.

The benthic community of Sagina Bay is comprised of pollution tolerant species in the old river channel out to Point Lookout and along the eastern shore of the inner bay.

Oligochaetes, nematodes, and chironomids make up the entire benthic community of the inner bay and the deeper areas of the inner bay near the shipping channel. Studies made on various Saginaw Bay fishes show that scuds, chironomids, and oligochaetes form the main diet for several species. Benthic communities determine fish types in given areas. For example, a community of burrowing worms (oligochaetes) and midge larvae (chironomids) would support a population of fish such as carp and suckers that root for their food. Scuds and midge fly larvae in bottom or plant communities would support species such as perch and walleye.

b. With the Project

In Saginaw Bay the winter operations of commercial ice fishermen are likely to be impacted to a greater degree than would the winter sport fishermen. Commercial ice fishermen will lose the ability to cross the bay on the ice with their gear as they have in the past, due to the vessel track in the ship channel. These men could sustain a 50 percent reduction in harvest.

Sport fishery impacts would occur in part to those individuals using the Bay City State Park as an access site. Perch fishing and future walleye fishing will receive the most significant impacts. Adverse impacts also would occur to the developing lake trout fishery since the shipping line would cut off access to the major portion of the trout fishing area.

Dredging of a berth and access channel in Bay City for a Type C icebreaker will destroy beaches and reduce shallow water fish habitat. The need by all vessels to use more power to traverse the ice-covered bay will resuspend sediments which may be polluted.

Continual breaking of a channel through Saginaw Bay could cause the ice sheets on either side of the bay to break away from the shore during high winds and cause shore damage and commercial fish net losses.

Ice rampart formation along the channel as a result of icebreaking action is another point of concern. Large blocks of ice, if formed in the inner bay by icebreaking action, could cause bottom scouring of shoreline spawning areas during break-up.

4. Wildlife

a. Without the Project

The lower Lake Huron Basin and Saginaw Bay provide a vital link in the total support and protection of waterfowl, shorebirds, marshbirds, and passerine birds which frequent the North American continent. The bay

is a nationally known waterfowl concentration area. It also supports numerous aquatic and terrestrial furbearers, upland game, and white-tailed deer.

An extensive waterfowl habitat complex exists in Saginaw Bay (Figure VIII-C-4-a-1) from Point AuGres to Bay City and north to Sand Point. Its border of excellent emergent vegetation and prime submerged plant beds provide feeding, resting, nesting and nursery habitat for transient and breeding ducks.

From the air, large numbers of ducks can be sighted during migration in the open water areas of Wigwam, Wildfowl, and Sebewaing Bays. Some "rafts" contain as many as one-quarter million birds during migration periods. Blue and snow geese have been sighted in large groups, ranging up to 20,000 to 25,000.

Substantial waterfowl breeding occurs throughout the Saginaw Bay area. Many of the basin's streams and marshlands are frequented by mallards, black ducks and teal.

A power plant at the mouth of the Saginaw River keeps some of the Bay waters open during the winter, making it possible for some waterfowl to overwinter.

Wildfowl Bay, stretching from Fish Point to Sand Point on the east side of Saginaw Bay, is the most heavily used area of the bay by both waterfowl and hunters. It extends about five miles out to the offshore islands and is approximately five to six feet deep. It contains about 415,000 acres of high quality waterfowl habitat.

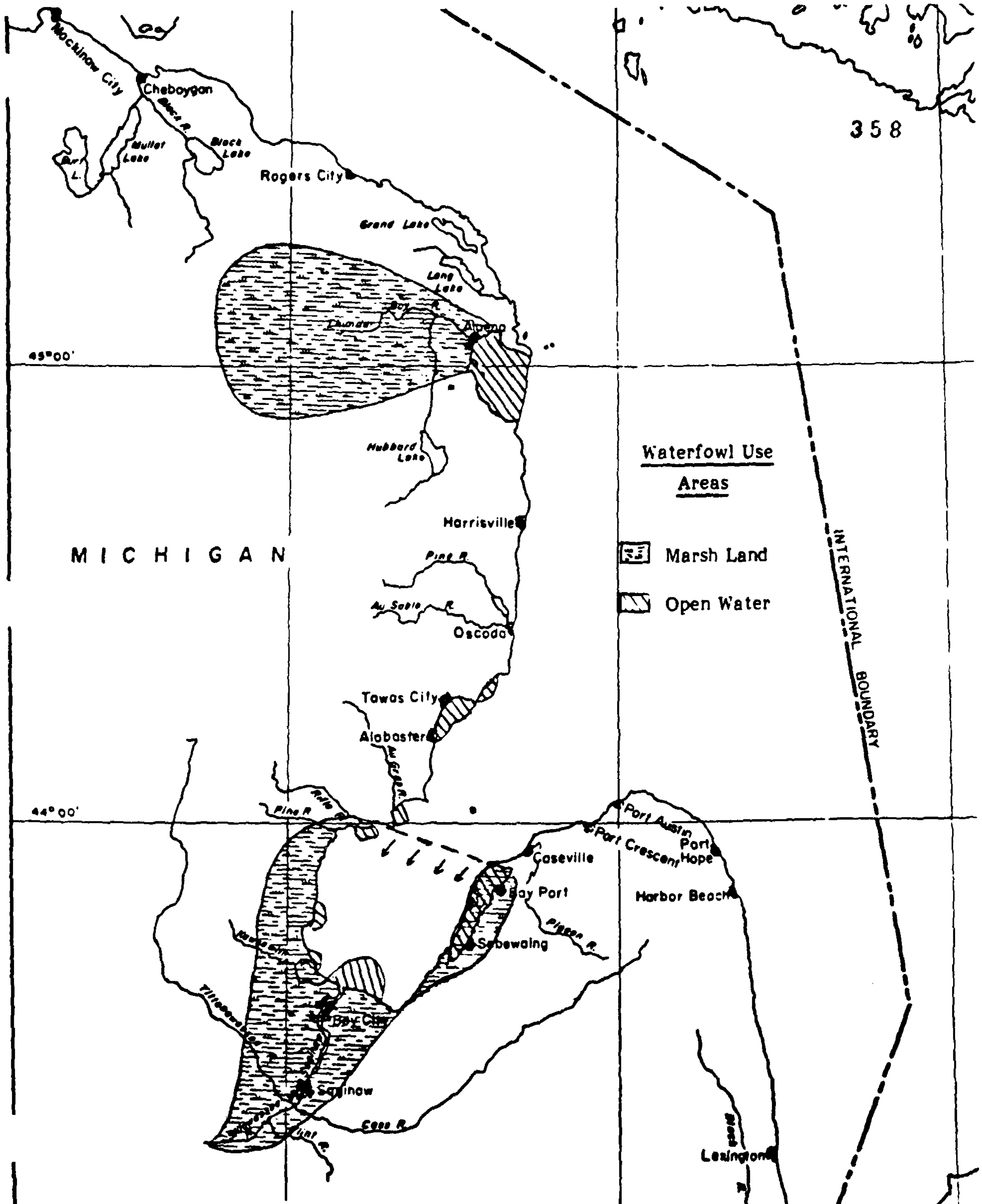


Figure VIII-C-4-a-1

An estimated 30 species of waterfowl and marsh birds are available to hunters during the period of October to December. The estimated annual waterfowl-use days on Saginaw Bay are 365,200 days. Many hunters travel great distances for the area's famous hunting. Hunting is allowed on most of the following state game and wildlife areas. It also occurs on portions of other state recreation areas in the bay area.

Name of Project	
Tobico Marsh State Game Area	1,829 acres
Fish Point Wildlife Srea	3,076 acres
Nayanquing Point Wildlife Area	1,003 acres
Quanicassee Bay Wildlife Area	217 acres
Wigwam Bay Wildlife Area	136 acres
Wildfowl Bay Wildlife Area	1,542 acres
Total Area	7,803 acres

Additionally, over 200 spccies of non-game and passerine birds utilize the area at various times of the year.

The lowlands and marshes bordering Saginaw Bay support muskrat and mink in the wetter areas and raccoon, weasel, skunk, opossum and fox in the drier areas. Since 1964, high water levels have favored muskrat production. Extended trapping seasons during this period have increased the harvest and exercised a control on the population. The number of mink trappers have been constant throughout the bay region, but the annual harvest has been steadily

dropping since 1964. Smaller numbers of other fur species such as skunk, opossum, fox, raccoon and weasel are trapped in the Bay area. Recent increases in prices of long-haired furs have stimulated interest in trapping.

Species on the Federal threatened or endangered species list which pass through the Saginaw Bay region include the Arctic peregrine falcon and the bald eagle.

b. With the Project

Open water areas generated in the ice near the navigation channel could be expected to be utilized by the resident goldeneye, oldsquaw and mergansers as resting areas but not as feeding areas. Benthic populations and aquatic vegetation beds in or near the vessel track could be destroyed or degraded by vessel scouring and subsequent sedimentation in the inner bay area. This could reduce utilization of affected areas by wildlife.

5. Discussion

The major impact that needs to be addressed is the probable disruption of the commercial and sport ice fishery on Saginaw Bay. Ship passage through the bay during winter will cause major problems for commercial fishermen working the inner bay area and for sport anglers seeking lake trout off Point Lookout and for perch and walleye in the inner bay area.

Measures will be needed to compensate for the loss of harvest and recreational potential as a result of winter shipping activities. Measures for loss of sport fishing could include

the installation of rock or other suitable material reef structures to concentrate the fish and thereby concentrate the anglers away from the channel areas. Similar structures for lake trout would be needed in the outer bay and for walleye and perch in the inner bay. Locations and sizes of those structures will be provided at a later date.

Compensation or mitigation for commercial fishermen also might consist of the installation of ice stabilization structures within the inner bay.

The only means to avoid the suspension of toxic substances caused by dredging of a berth and possible access channel for the Coast Guard icebreaker at Bay City would be to forego the dredging. If the spoils are classified as polluted, we assume a suitable impermeable site would be found for their disposal so that no material returns to the water.

Because of the heavy use of the bay by fishermen using snowmobiles and recreational snowmobilers, any ice channel cut should be clearly marked so as to warn the snowmobilers.

Vessel speed reduction can reduce the amount of resuspension of polluted sediments and turbidity in the inner bay. This would reduce the incidence of pressure waves and reduce propeller wash.

6. Recommendations

The following recommendations supplement those listed previously for the Great Lakes Basin, Part F:

(1) Reef structures should be constructed to concentrate fish away from channel areas.

(2) Develop ice stabilization structures to facilitate commercial fishing operations.

(3) An impermeable upland site for disposal of any polluted dredged materials should be developed if project related dredging is necessary.

D. Drummond Island

1. Description of Area

Drummond Island is a large irregular-shaped island about 20 miles long and 12 miles wide situated in Lake Huron along the lower St. Marys River and between the Province of Ontario, Canada's North Channel. It has many shoreline indentations and bays, and has numerous, small, satellite islands. The International boundary separating the United States and Canada encircles the Island on three sides --the west, the north, and the east. DeTour Village is located across the St. Marys River, opposite Drummond Island.

The Island is heavily wooded and is an important resort and recreational area for summer residents and tourists. A large portion of Drummond Island is owned by the Michigan Department of Natural Resources. There are a number of privately-owned homes and cottages, some of which are occupied on a year-around basis.

The harbor at Drummond Island consists of a loading dock and appurtenant facilities on the St. Marys River for deep draft vessels. It is owned and operated by the Drummond Dolomite Corporation, an establishment engaged in large-scale, rock quarrying and lake transporting operations. The industry is dependent upon the utilization of the vast Niagaran dolomite formations that underlie Drummond Island. The transported product is crushed dolomite stone, which is later sized and graded for construction and other related purposes.

2. Description of Project

The Corps of Engineers has considered several alternative measures for the potential problems of vessel movement through ice at the harbor entrance, and in the harbor.

The plans to be implemented for the extended season navigation project at Drummond Island Harbor entail measures for the ferry service and at the Drummond Dolomite Corporation loading dock. To enable ferry service and extended season navigation at the harbor, proposed plans call for the installation of compressed air bubbler systems and an ice boom to deflect ice away from the dock. Air bubbler dispensing pipes would be supplied from onshore compressors. When in operation, the bubbler system would weaken the ice, facilitating ferry passage.

3. Fish

a. Without the Project

For most considerations, the Drummond Island Harbor fishery is considered to be that of the St. Marys River.

There is unrestricted movement of fish to and from the St. Marys River, the waters of Drummond Island Harbor, and Lake Huron.

The river bottom near the harbor site is believed to be sandy and strewn with pebbles and cobbles. The current is strong and the bottom should be clean of detritus. Clams are common benthos in the river and could be expected to be found at the harbor site.

The constant supply of well oxygenated cold water allows the broad spectrum of species to develop within the St. Marys River System at the Drummond Island project site. In the summer, walleye, yellow perch, smallmouth bass, and northern pike are the primary sport fish caught in the area. Nearby, Potagannissing Bay supports a strong sport fishery, and in essence is a lake within the system with warm and cold water fish populations.

Ice fishing for lake trout and splake is becoming increasingly important in the St. Marys River and Drummond Island area. In recent years, the area southwest of the Village of DeTour has become a noted commercial whitefish trapnet fishery and winter lake trout sport fishery. Seasonal migrations of lake whitefish, lake herring, rainbow smelt, lake trout, brown trout, and rainbow trout occur for spawning or temperature regulation purposes. Coho and shinook salmon also use the area at times.

It is expected that the traditional method of residents to get to the mainland by snowmobile or car would not be satisfactory. Icebreaking interferes with that mode. The ferry would have to operate with icebreaker assistance on an as-needed basis.

b. With the Project

Commercial vessels, the ferry, and icebreakers would ply the river disrupting ice fishing activities and creating undesirable conditions from propeller wash and churning of the river bottom sediments. There would be a large increase in the annual amount of vessel traffic under the navigation season extension project.

The installation and operation of an air bubbler system and ice boom along the Drummond Dolomite Corporation's dock and the ferry dock is not expected to have any effect on ice fishing opportunities. The dock is not publicly owned, and winter ice fishing activity at the site is nonexistent or inconsequential. The operation of the proposed bubbler system is also not expected to have any measurable adverse impacts on fishery resources or their habitats.

4. Wildlife

a. Without the Project

Wildlife use of the immediate Drummond Island dock site is very limited since it provides little habitat. Even so, a variety of shore birds and migrating waterfowl do utilize the site. The principal shorebirds finding habitat are terns, gulls, killdeer, snipe, sandpipers and plovers. Migrating waterfowl can be expected to temporarily visit the harbor area during spring and fall migrations. These include: black duck, mallard, blue-winged teal, green-winged teal, wood duck, baldpate,

pintail, gadwall, ringneck, lesser scaup, greater scaup, redhead, canvasback, goldeneye, bufflehead, ruddy duck, blue goose, Canada goose, American merganser, red-breasted merganser, coot and whistling swan.

Further inland from the harbor site on Drummond Island, wildlife habitat is diverse and supports a wide variety of wildlife species. The forest cover is important to white-tailed deer, black bears, bobcats, red fox, coyotes, woodcock, ruffed grouse, and red squirrels. There are a few lynx reported on the island along with a remnant population of sharp-tailed grouse. Porcupines are few in number, if present at all.

There are no known plant or wildlife species inhabiting the harbor area that are included on the Federal list of endangered and threatened wildlife and plants.

Projected wildlife resources associated with the Drummond Island Harbor site are not expected to change to any measurable degree in the absence of the extended navigation season project. Wildlife use of the site is not important now, and future conditions for wildlife are not expected to differ.

b. With the Project

Installation of the proposed ice boom and air bubbler system above the dock and in the St. Marys River, respectively, will not alter wildlife habitat or affect wildlife resources to any significant extent. Should icebreaker assistance be required to keep the harbor and entrance open, only minimal damage to the shore or bottom is envisioned.

5. Discussion

The effects of an extended navigation season on fish and wildlife resources at Drummond Island Harbor is not expected to be severe. The fishery resource would be affected the most due to the disturbances of bottom sediments and disruption of normal fish activities. It is not believed, however, that the effects on fishery resources will be significant. This view is based on the Fish and Wildlife Service's present knowledge of the Drummond Island project site and our current understanding of the measures proposed for installation at the site. It is possible that additional data and information will point out areas of concern and needed corrective actions. Studies proposed in the Environmental Plan of Action will identify these concerns and actions.

6. Recommendations

The recommendations applicable to Drummond Island are those listed for the Great Lakes Basin, Part F.

E. Stoneport Harbor

1. Description of Area

Stoneport Harbor is a private small docking and loading facility on Lake Huron in the southern part of Presque Isle County, Michigan, about midway between Rogers City and Alpena. The harbor, which has been partially excavated out of bedrock, is used for the loading and transfer of commercial stone and gravel to deep-draft vessels. The facilities and adjacent lands are owned by the Presque Isle Corporation.

Water quality in Stoneport Harbor is high, reflecting the overall excellent quality of water in Lake Huron proper.

Existing topographical features have resulted from Ice Age events. The flat and undulating areas were formed from glacial outwash, till, or lakebed plains, while the hills are largely of morainic origin. Marshes are widely distributed and form an intricate drainage network pattern.

2. Description of Project

No modifications are planned for Stoneport Harbor.

3. Fish and Wildlife Resources

The waters of Stoneport Harbor are clear and clean with the rock bottom visible at depths of up to twenty feet. Boulders and cobble along the shipping dock and shoreline provide ideal habitat for forage and predator fish.

Little specific information is available on fish species inhabiting Stoneport Harbor proper. The Michigan Department of Natural Resources has a sampling station offshore of Stoneport Harbor in the deeper waters of Lake Huron, but information from the station may or may not apply to the harbor.

Recent sampling efforts revealed the presence of rainbow smelt, ninespine sticklebacks, and shiners. Sticklebacks were so numerous near dock walls at the time that the water appeared to be black. This abundance of forage species is a good indication that cold water predatory species also

inhabit the harbor. Splake and lake trout have reportedly been observed in the harbor from time to time. The bloater is associated with shallow waters and may be abundant inshore. Brown trout have been planted five miles south, at Rockport, and may also enter Stoneport Harbor.

Fishing pressure in the harbor is very light. Land access to the harbor is prohibited as the surrounding property is owned by the Presque Isle Corporation and is posted. Entry to the harbor is on a "permission only" basis or from the lake. There have been unsubstantiated reports of sport fishermen catching splake, lake trout, and yellow perch at the dock. Most local fishing pressure is at Bell Bay about 1-1/2 miles southeast of the harbor. There is no commercial fishery in the harbor area.

There are no species of fish known to inhabit Stoneport Harbor that are included on the Federal list of Endangered and Threatened Wildlife and Plants.

The harbor of Stoneport provides little habitat for wildlife species other than shorebirds and migrating waterfowl. However, wildlife abounds in the wooded cover in the vicinity of the harbor.

Big game animals include white-tailed deer and black bear. Numbers of both species have undergone a general decline over the past several years. Wild turkeys are also reported in the area and their populations may be increasing.

Goldeneye and bufflehead ducks have been observed on Stoneport Harbor. These species and other diving ducks normally frequent

the Great Lakes through the winter months and are often found in open water areas in and near harbors. Other species of waterfowl occurring in the Lake Huron Basin that can also be expected to visit Stoneport Harbor during spring and fall migrations are: black duck, mallards, blue-winged teal, wood duck, baldpate, pintail, gadwall, ringneck scaup, greater scaup, redhead, canvasback, goldeneye, bufflehead, ruddy duck, blue goose, snow goose, Canada goose, American merganser, red-breasted merganser, coot and whistling swans.

Terns, gulls, killdeer, and shorebirds also may be observed along portions of harbor shoreline during summer months.

Furbearing animals are common, including muskrat, mink, beaver, weasel raccoon, skunk, and badger. Non-game animals found throughout the project vicinity are woodchuck, red fox, red squirrel, coyote and raptors.

There are no known active bald eagle nests within the vicinity.

The Kirtland's warbler, the American peregrine falcon and the Arctic peregrine falcon may migrate through the general area in which Stoneport Harbor is located. These endangered birds, however, do not nest near or utilize the harbor as habitat.

The Fish and Wildlife Service has not been informed of any specific plans to facilitate winter shipping at Stoneport Harbor. If and when concrete proposals regarding harbor improvements are received, the Service will evaluate those proposals with respect to their potential impacts on fish and wildlife resources and make appropriate recommendations for the elimination or minimization of those impacts.

F. St. Ignace

1. Description of Area

St. Ignace is a community of about 3,500 persons located on the Upper Peninsula of Michigan at the Straits of Mackinac in Mackinac County. The economy of St. Ignace is derived almost exclusively from tourism and recreational activity. It lies at the foot of the Mackinac Bridge and is the mainland terminal for Mackinac Island.

The harbor is a natural bay not needing breakwaters. The facilities consist mostly of recreational facilities with an active railroad ferry dock. There are several inactive docking facilities where the old car ferrys docked before the Mackinac Bridge was constructed. Harbor depths are such that the railroad ferry ca be accommodated. The Coast Guard has an existing facility on the lake, just south of town, near the State park.

Water quality and the harbor bottom condition are unknown at this time. Possible sources of water pollution would be the wastes from recreational watercraft, the wastes and spills from the railroad ferry, and sewage effluent from the town and State park.

2. Description of Project

This project plan proposes a Type C icebreaker be stationed here, at the Straits of Mackinac and close to the lower end of the St. Marys River. This would require onshore storage area, a mooring dock, and the probable dredging of an access channel from the pier, to the nearest deep water. Specific locations and plans for these facilities were not included.

3. Fish and Wildlife Resources

The fishery of St. Ignace harbor is not known at this time. However, the species composition undoubtedly is similar to that of the adjacent lake. Common species include lake trout, splake, rainbow trout, smallmouth bass, walleye, northern pike, whitefishes, coho and chinook salmon, yellow perch, alewife, and rainbow smelt. Because St. Ignace is a concentration point of recreationists, including fishermen, the area sustains heavy fishing pressure.

The important terrestrial wildlife of the area for the hunter consists of white-tailed deer, black bear, bobcat, snowshoe hare, red fox, coyote, ruffed grouse, woodcock, and red squirrel. Since the harbor is located in the urban setting of the town, none of this wildlife would be affected by the navigation season extension. Waterfowl and shorebirds do use the harbor area during the ice-free period. Most of this use is during migration. Since recreational watercraft traffic is heavy in the summer tourist season, the summer use by waterfowl is limited. There is little, if any, waterbird use of the area in winter.

There are no known rare, endangered, or threatened species of fish or wildlife that use the harbor area. Bald eagles, known to frequent shoreline areas east of St. Ignace, may occasionally be observed at the harbor.

The proposed icebreaker mooring facilities are not detailed enough to determine the effects on fish and wildlife resources.

IX. LAKE ERIE

A. Description of Area

The Lake Erie Drainage Basin includes portions of five states, with approximately 20,000 square miles in Michigan, Indiana, Ohio, Pennsylvania, and New York. (Figure XI-A-1.) In addition, the Province of Ontario, Canada, includes about 10,000 square miles of the basin.

Lake Erie, fourth in size of the five Great Lakes, is about 240 miles long and more than 50 miles wide near the mid-point of its long axis. The total water surface area amounts to 9,910 square miles, with 4,980 square miles within the United States and 4,930 square miles within Canada.

The Lake is by far the shallowest of the Great Lakes and the only one with its entire water mass above sea level. Lake Erie has the smallest volume of the Great Lakes and is the most fertile and productive. The lake has the flattest bottom and is subject to wide short-term fluctuations in water level.

Mean annual precipitation is about 34 inches. It ranges from 32 to 48 inches, and increases from north to south and west to east. Prevailing winds average about 10 mph in the basin and are from the south and west. Most of the basin experiences more than 150 frost-free days. Snowfall averages 40 to 100 inches annually from west to east over the basin. During most years

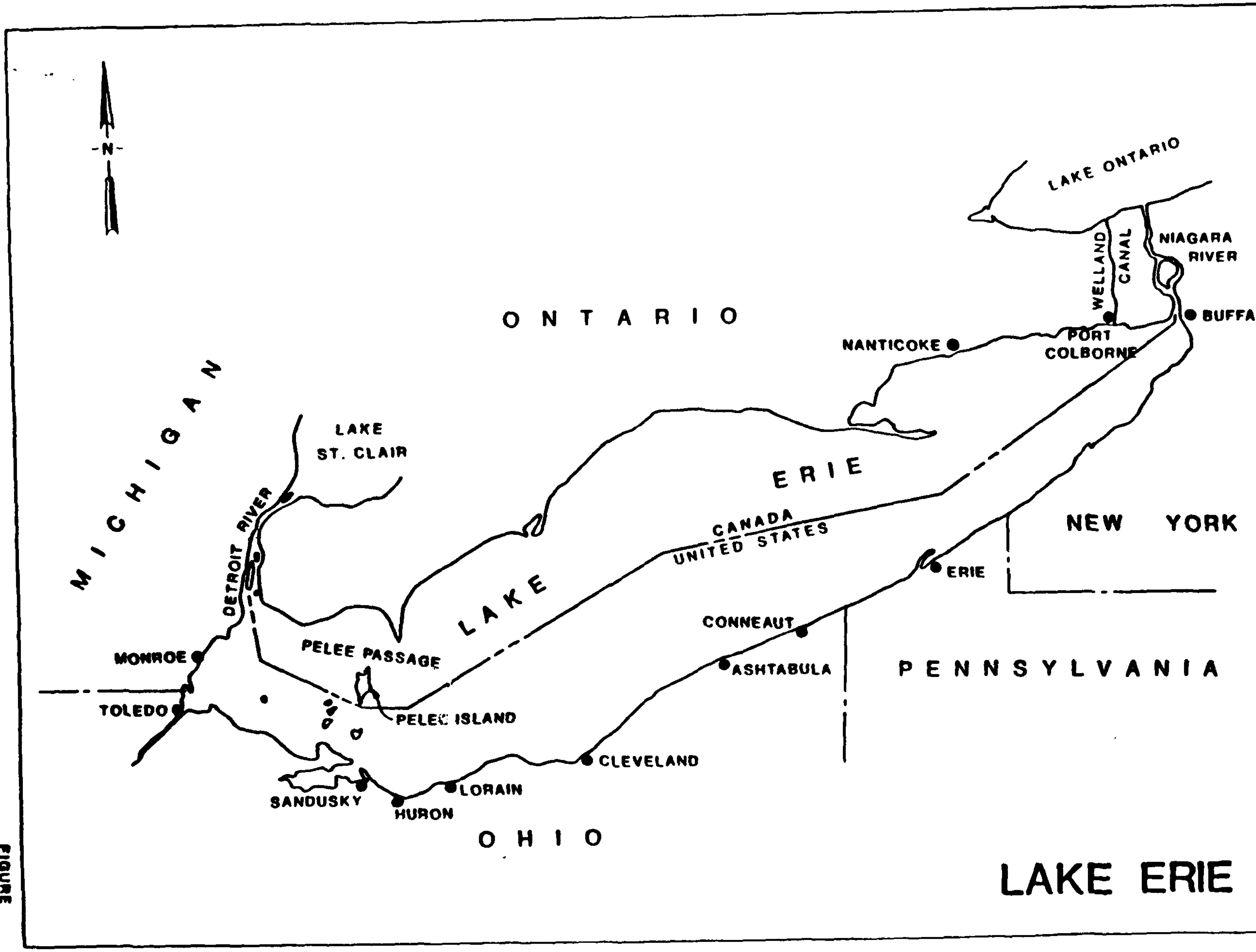

LAKE ERIE
N
LAKE ONTARIO
WELLAND CANAL
NIAGARA RIVER
BUFFALO
PORT COLBORNE
NANTICOKE
ONTARIO
MICHIGAN
LAKE ST. CLAIR
DETROIT RIVER
LAKE ERIE
CANADA
UNITED STATES
NEW YORK
ERIE
PENNSYLVANIA
CONNEAUT
ASHTABULA
PELEE PASSAGE
PELEE ISLAND
MONROE
TOLEDO
CLEVELAND
LORAIN
HURON
SANDUSKY
OHIO

FIGURE IX-A-1

ice formation on Lake Erie is relatively greater than on any of the other four Great Lakes. The western basin, shallow bays, and protected areas are normally ice-covered from mid-January to mid-April.

The Lake Erie basin is very urbanized, with 88 percent of its population residing in the 10 major urban areas of Detroit and Ann Arbor, Michigan; Fort Wayne, Indiana; Lima, Toledo, Akron, Cleveland, and Lorain-Elyria, Ohio; Erie, Pennsylvania; and Buffalo, New York.

The Lake Erie region is now characterized by an economy which relies upon industry, manufacturing, agriculture, tourism and recreation. Industrial activity is concentrated in the highly populated metropolitan areas. The chief products of manufacturing are automobiles, fabricated metal, primary metals, rubber, food, petroleum, chemicals, and paper.

Water quality of the Lake Erie Basin has been severely degraded by pollution. Some of the most serious water quality problems are manifest in the nearshore zone. Obviously, point sources of pollution are clustered along the shoreline and circulation of many nearshore waters is restricted by breakwalls and other structures, resulting in semi-entrapment of pollutants. Less obviously, prevailing long shore currents tend to prevent dispersion of nearshore waters and its pollutants into the greater volume of mid-lake. A good example is the Lower Cuyahoga River and the associated estuary which are so polluted that water quality standards have been relaxed for the area.

Much concern has been expressed about the eutrophication of Lake Erie. High nutrient concentrations have resulted in algae growth problems in parts of the lake. Consequently, it is the policy of the U.S. Environmental Protection Agency to require phosphorus reduction by wastewater treatment plants. The International Joint Commission recommended the same in their 1969 study. The 1972 Executive Agreement between the United States and Canada established the maximum permissible phosphorus loadings into Lake Erie from each country through 1976. However, large amounts of phosphorus still enter the lake from municipalities without facilities and from non-point sources. The State of Ohio is currently considering legislation banning phosphate detergents. Such a measure would significantly reduce phosphorus loadings from municipal discharge.

Oxygen depletion in Lake Erie, caused primarily by bacterial oxidation of organic matter, is a phenomenon that has caused far reaching changes in the limnological regime of the lake. Midsummer anoxic conditions in the Lake Erie central basin have gradually increased in extent and severity during the past 28 years. Control of this problem is based upon the reduction of nutrient and BOD loadings to the lake.

At the present time thermal pollution does not appear to have a wide-spread effect on Lake Erie. The future growth of power plants on the lake may significantly alter this picture.

Toxic and hazardous materials represent a threat to water quality in Lake Erie. While present concentrations of toxic compounds in the lake are very low, they can and often are bio-accumulated in aquatic organisms. Mercury contamination of fish is a problem in the western part of Lake Erie. Polychlorinated bi-phenols (PCB's) and some pesticide concentrations are also increasing in the lake.

In the last several years, the water quality of Lake Erie has improved. This change reflects improvements in municipal and industrial wastewater treatment facilities; further improvements are planned. The legislative framework has been provided for continued improvements with Best Available Technology to be used at all treatment plants by 1983 and zero discharge of pollutants by 1985. However, much controversy exists as to the economic feasibility of these objectives.

The Ottawa National Wildlife Refuge is situated on the south shore of Lake Erie, about 20 miles east of the City of Toledo, Ohio. This establishment, and other smaller refuge units, comprise several thousand acres of marshland habitat, managed by the U.S. Fish and Wildlife Service as a component of the National Wildlife Refuge System. The Refuge areas are managed principally for migrating waterfowl resources, and represent remnant areas of the vast marshlands that once bordered western Lake Erie.

Principal U.S. harbors on Lake Erie proper include Buffalo, Erie, Conneaut, Ashtabula, Fairport, Cleveland, Lorain, Huron, Sandusky, Port Clinton, Toledo, and Monroe.

B. Description of Project

As a result of improvements at selected harbors of Lake Erie, additional icebreaking and vessel traffic on the lake are anticipated.

It is currently proposed that icebreakers will break single vessel track extending from the mouth of the Detroit River through the Pelee Passage to the entrance of the Welland Canal at Port Colborne, Ontario, Canada. Ancillary vessel tracks would also be required to the U.S. harbors of Monroe, Toledo, Sandusky, Huron, Lorain, Cleveland, Fairport, Ashtabula, Conneaut, Erie, and Buffalo. Several additional icebreakers will be added to the Coast Guard fleet, some of which will require new mooring facilities. Icebreaker operations and mooring facilities for the icebreakers may necessitate additional dredging projects.

The specific operational measures proposed for implementation of extended season operation on the Lake Erie portion of the system are:

Icebreaking

Icebreaking will be required on the main lake and at selected harbors. Ice forms include sheet, drift and pancake ice. The additional icebreakers will be of two types, the deep-draft polar Type B and shallower draft Type C breaker. Icebreaking tugs will be used in the harbors.

Icebreaker Mooring Improvements

The additional icebreakers would need mooring facilities and pier space. In some locations additional facilities are not needed. Tentative proposals for the Lake Erie sector would require the construction of a Type B and a Type C icebreaker facility at Detroit, Michigan, and a Type C facility in Toledo, Ohio. The system would also require construction of a Type B icebreaker facility in Cleveland, Ohio, and Type C icebreaker facilities in Erie, Pennsylvania.

Vessel Traffic Control

Vessels in transit will be monitored through a series of preselected check points. Traffic control is designed to prevent collisions and groundings. The vessels will check in with a traffic center.

Ice/Weather Data Collection/Dissemination Systems

An Ice Navigation Center was established for the Winter Navigation Demonstration Program. This center receives and disseminates information on ice conditions, weather, and related topics.

Aids to Navigation

These developments include the use of Loran C, navigation lights, beacons, fog signals and radar reflectors. There will be one (1) fixed navigation light with radar transponders (RACON) constructed and located in Toledo Harbor. The effect of these developments on fish and wildlife resources will be insignificant.

Ice Control Structures

These structures are the proposed ice booms. Ice booms are floating logs or metal cylinders chained together and anchored to the bottom. The construction of ice booms is proposed in both the St. Clair and Detroit Rivers to control ice flows. These two structures will have an effect on water levels of Lake Erie. (See description, discussion and recommendations for these structures in the appropriate section.) In Lake Erie, these structures will also be placed at entrances to the harbors of Huron, Lorain, Cleveland, Astabula, Conneaut and Buffalo to keep drift ice from jamming the entrances and making them impassible. The anchors will be left in place, but the floats will be removed in spring and replaced in the fall.

Air Bubbler Systems

These developments consist of long perforated pipes, a supply pipe and air compressors. The bubbler orifices are about 20 feet apart. The air pressures used in the system would be between 10 and 15 psi. They are not designed to keep an area ice free, but to reduce the thickness of ice so it can easily be broken. In Lake Erie, bubblers are proposed along docks and channels at the harbors of Monroe, Sandusky, Huron and Erie.

Dredging

Dredging proposed for Lake Erie winter navigation includes that amount needed in harbors to accommodate icebreaker facilities. Spoil disposal plans are not known at this time. Most dredging

would occur in harbors where polluted spoil may be present. Plans include dredging deep draft channels from the regular navigation channel to the mooring facility. If the spoil is determined to be polluted, it must be deposited in confined spoil areas.

Compensating Works

There are no compensating works proposed on Lake Erie. However, compensating works are proposed for construction on the St. Clair and Detroit River. The compensating works will be designed to minimize the effects of ice booms at the head of the St. Clair and Detroit Rivers on Lake Erie water levels. If this is accomplished, there should be no adverse effects on the fish and wildlife resources of Lake Erie.

Shoreline Protection

There presently are no proposed shoreline protection measures for the Lake Erie area. Studies are underway to define areas of shoreline erosion and structure damages. Those studies may document the need for shore protection.

Water Level Monitoring

Monitoring will be done in the connecting channels. There would be no effects on fish and wildlife resources.

Vessel Speed Control and Enforcement

The U. S. Coast Guard is responsible for the control and enforcement of vessels and their speed. The Coast Guard sees no need to change present speed limits because shoreline damages and erosion are the responsibility of the vessel operator. Cause of damage is determined by the Coast Guard.

Safety/Survival Requirements

These developments will not affect fish and wildlife resources.

Vessel Operating and Design Criteria

These criteria have been developed to promote safe vessel operation in all United States waters. For vessels operating in ice, the criteria are explicit about hull strength, power plant size, strengthened steering mechanisms, special propellers and other special gear. There also are special criteria for oil and hazardous substance transports. Enforcement of these criteria will reduce the probability and severity of winter oil and hazardous substance spills. Adoption of those criteria are the responsibility of the owner and at his option. Vessels are presently and will continue to operate in disregard to those criteria in winter unless their adoption is made mandatory. No additional regulations or enforcement are proposed at this time by the Coast Guard.

Search and Rescue Requirements

These requirements will not affect fish and wildlife resources.

Oil/Hazardous Substance Contingency Plans

The Coast Guard is the designated responsible agency for these plans on the Great Lakes. They believe that present plans are adequate. These plans include one stockpile of materials used to contain spills located at Cleveland. A Regional Response Team also exists and the Service is a member. The National Strike Force, a highly trained Coast Guard unit whose purpose is oil spill containment, has a four-hour response time to spills in the Great Lakes area. The actual cleanup of a spill is contracted to private companies. Oil, hazardous material and toxic substance spills are a potential source of major adverse environmental impacts from this project.

Vessel Waste Discharge (Non-human) Requirements

These requirements and standards have been set and enforced by EPA. These requirements include the equivalent of secondary treatment. No wastes are to be discharged into the waters of the lakes. The problem of disposing of these wastes in special harbor facilities is being studied.

Environmental Plan of Action

The Fish and Wildlife Service and the Corps of Engineers have determined that much information is needed to make a precise

evaluation of project effects. The EPOA is an attempt to acquire and evaluate the needed information and predict the effects of the project. The EPOA will provide for monitoring project developments, and will culminate in a report recommending ways to eliminate or minimize adverse effects.

C. Fish

1. Without the Project

Fish distribution and composition in Lake Erie differs from the rest of the Great Lakes for a number of reasons, chief among them being water temperature, thermal stratification, bottom type, pollutional changes and high utilization. Many once-abundant fish species have disappeared or declined drastically in recent years. Other species have been purposely or accidently introduced by man. Of the 95 species listed in 1970, almost 20 percent are species which were introduced and did not become established, or were native species which have virtually become extinct. The Ohio Division of Wildlife estimates current relative species composition, or ranking, on a lakewide basis. These rankings show a species composition dominated by warmwater species such as freshwater drum, gizzard shad, emerald shiner, white bass, carp, and the most abundant, but declining species --yellow perch.

The distribution of some of the major species is as follows:

Alewife -- dramatically varying distribution. Spring distribution limited almost exclusively to the shallow western basin. Fall distribution is more general with fish present throughout the lake, but are most prevalent at depths of 50 - 70 feet in the central basin.

Gizzard shad -- most abundant throughout the year in the western basin, particularly the shallow periphery waters and bays. They move to deeper water during fall. Shad are extremely susceptible to thermal shock.

Coho salmon -- a species in which the individual fish migrate to their natal stream. Coho distribution is dependent upon stocking in the Huron River, Chagrin River and Conneaut Creek. Distribution studies show that over winter, coho were found at warm-water outlets near Cleveland and Lorain. During early spring, coho were most prevalent along the south shore of the western basin and in Sandusky Bay and Maumee Bay. Coho moved to the north shore of the western basin during the early summer and moved progressively east before returning to the south shore in early fall. They feed heavily nearshore enroute to spawning streams.

Lake whitefish -- historically concentrated in the western basin during the fall, particularly in the Maumee Bay area and around the Bass Islands. By early spring, whitefish were largely gone from the western basin and found in the deeper waters of the central basin, where they remain until returning to the western basin in the fall.

Smelt -- most prevalent in the deeper waters of the lake throughout most of the year. The exception is during late March and early April when adults move inshore to spawning streams. The only known spawning streams in Ohio are in the eastern lake-shore counties, particularly Lake and Ashtabula. Some smelt eggs have been found on shoals around the islands in the western basin. Shortly after spawning, smelt move back to deeper waters. At this time they are common in the western basin, particularly around the Bass Islands, as they move from major spawning streams along the north shore of the western basin to deeper water. By June, most yearling smelt were concentrated in water 50 feet deep in the southeastern part of the central basin off Conneaut. Young-of-the-year smelt move offshore by June and are most prevalent off Huron to Lorain in water 45 feet deep or less. By late fall, all ages were generally distributed throughout the lake as far west as Port Clinton.

Carp -- most abundant in shallow near-shore waters of the western basin, Sandusky Bay and Maumee Bay. They are found in some inshore waters in the central basin, particularly the more protected waters in major harbors. They are distributed in shallow water throughout the spring and summer and move into the deeper water of the western basin during the fall.

Common white sucker -- ascend tributaries in early spring to spawn, then return to the shallow waters nearshore. During mid-summer, they are in the deeper areas in the western basin between West Sister and Middle Sister Islands. In October, they are captured at all stations in the western basin and in the central basin.

Channel catfish -- surveys have shown channel catfish limited almost exclusively to the western basin. Limited numbers are found in the nearshore areas and harbors in the central basin. Channel catfish are distributed along the south shore and in Sandusky Bay during spring and early summer. In late summer and early fall, they moved to deeper water offshore, particularly around Bass Islands and Kellys Island to overwinter.

Smallmouth bass -- currently most abundant in the island area of western Lake Erie and adjacent shoals, plus some nearshore shoal or rocky areas in the Huron, Lorain, Ashtabula and Conneaut areas.

White bass -- general distribution throughout the lake, but most common in the western basin. Immature yearlings are found at shallow nearshore areas during spring and summer. The greatest concentration of adults occur during April in Sandusky Bay, and in May and June on spawning reefs in the western basin and around Bass Islands. They are more evenly distributed during the summer, but still in the vicinity of shoal water. There is some evidence that all ages move to deeper water in the fall; possibly into the central basin. The white bass is extremely susceptible to thermal shock.

Walleye -- early spring distribution is concentrated in Sandusky Bay, Maumee Bay and along the south shore beach. They move to river and shoal spawning areas in April.

During summer and fall, they are generally distributed in the shoal and island areas. They generally overwinter in deep water, particularly adjacent to the islands.

Sauger -- distribution of reintroduced sauger seems to be limited primarily to the Sandusky Bay area with some occurrence along the south shore from Port Clinton to Lorain and also the extreme west end of the lake and around the Bass Islands. The preference for Sandusky Bay may be the result of a homing tendency. Sauger were stocked in 1974, 1975, 1976, but not 1977. Capture of a 1977 year class sauger suggested that limited natural reproduction occurred.

Yellow perch -- very widely distributed. Most prevalent in western basin. During the spring, the mature fish are distributed more inshore for spawning while immature fish are still found throughout the lake at all depths.

Freshwater drum -- most abundant in the western basin but considered widespread in distribution being captured at all areas of Ohio waters. Spawning occurs anywhere from bays and shoals to open lake. During the May to June spawning peak, drum are most numerous in the shallow nearshore waters and Sandusky Bay. In October, drum are drastically reduced in numbers in 36 to 60 feet of water in the central basin. Dramatic offshore movement to deeper water from mid-September to mid-October.

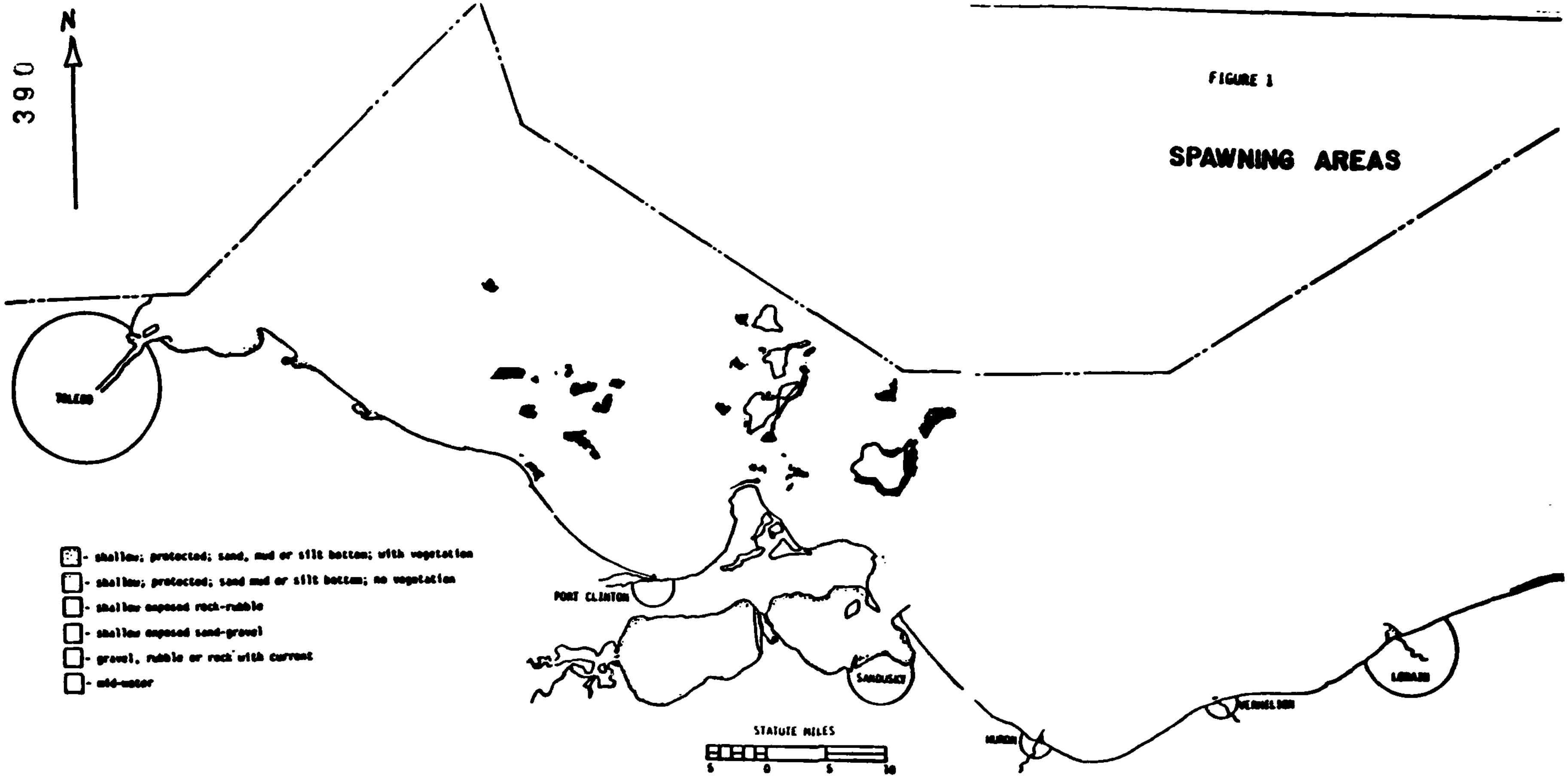
Habitat use can best be addressed by categories: Spawning areas, overwintering areas, feeding areas, nursery areas, and migration areas. Figure IX-C-1, 1A, 2, 2A, 3, 3A, 4, and 4A, dilineate location and extent of critical habitat. Figures show that the important fish habitats in Lake Erie include the nearshore waters (to a depth of approximately 20 feet), all bays and estuaries and all offshore shoal areas. The Ohio Division of Wildlife has designated several critical fisheries areas for their protection. Included in this group are all of Maumee Bay, the Bass and Kellys Island areas, the entire Locust Point reef complex, the near-shore Ruggles Reef area between Huron and Vermillion, and all of Sandusky Bay. Sandusky Bay reportedly produces 30% of Ohio's commercial fish catch.

Sport fishermen most utilize the area from Vermillion to Lorain including the Catawba and the island area. The commercial fishermen historically utilized Sandusky Bay, the south shore of the western basin and the nearshore central basin, particularly in the vicinity of major fishing ports.

The management of the fishery in Lake Erie includes restoration of desirable species by stocking, imposing restrictions on gear, regulating fish sizes, and use of abundance predictions for adjustments of harvest rates. The goal of

FIGURE 1

SPAWNING AREAS



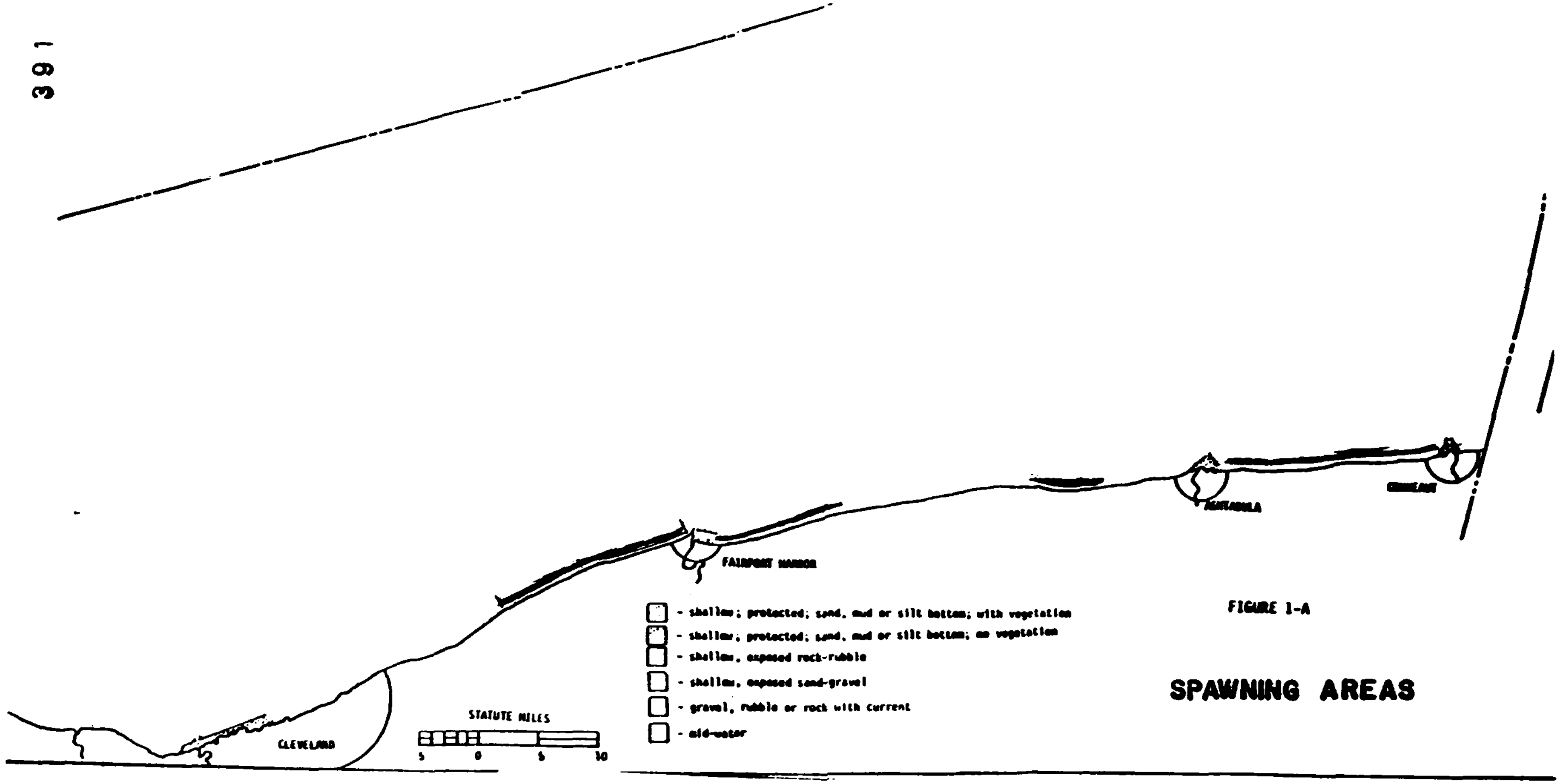
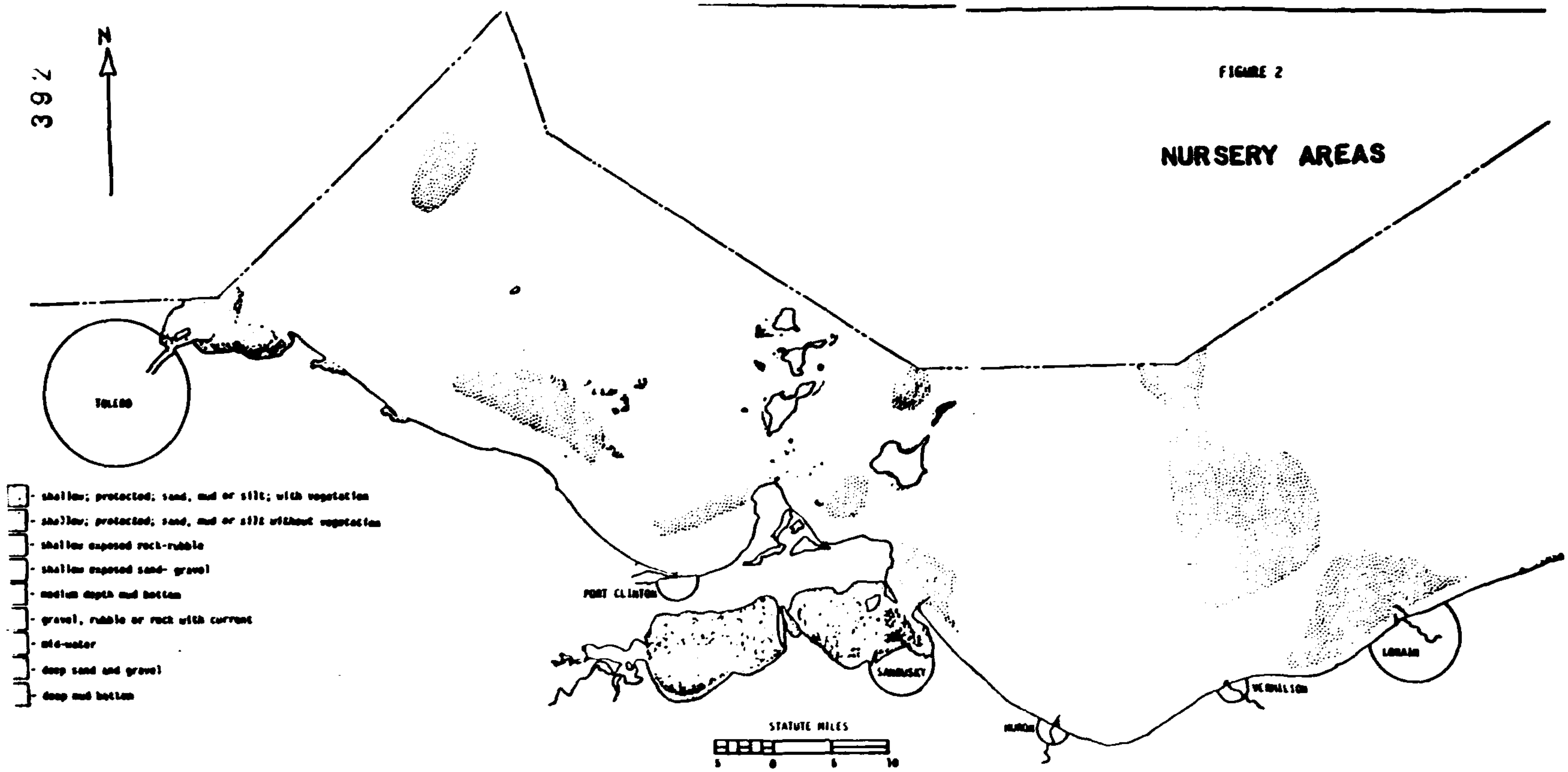


FIGURE 1-A

SPAWNING AREAS

FIGURE 2

NURSERY AREAS



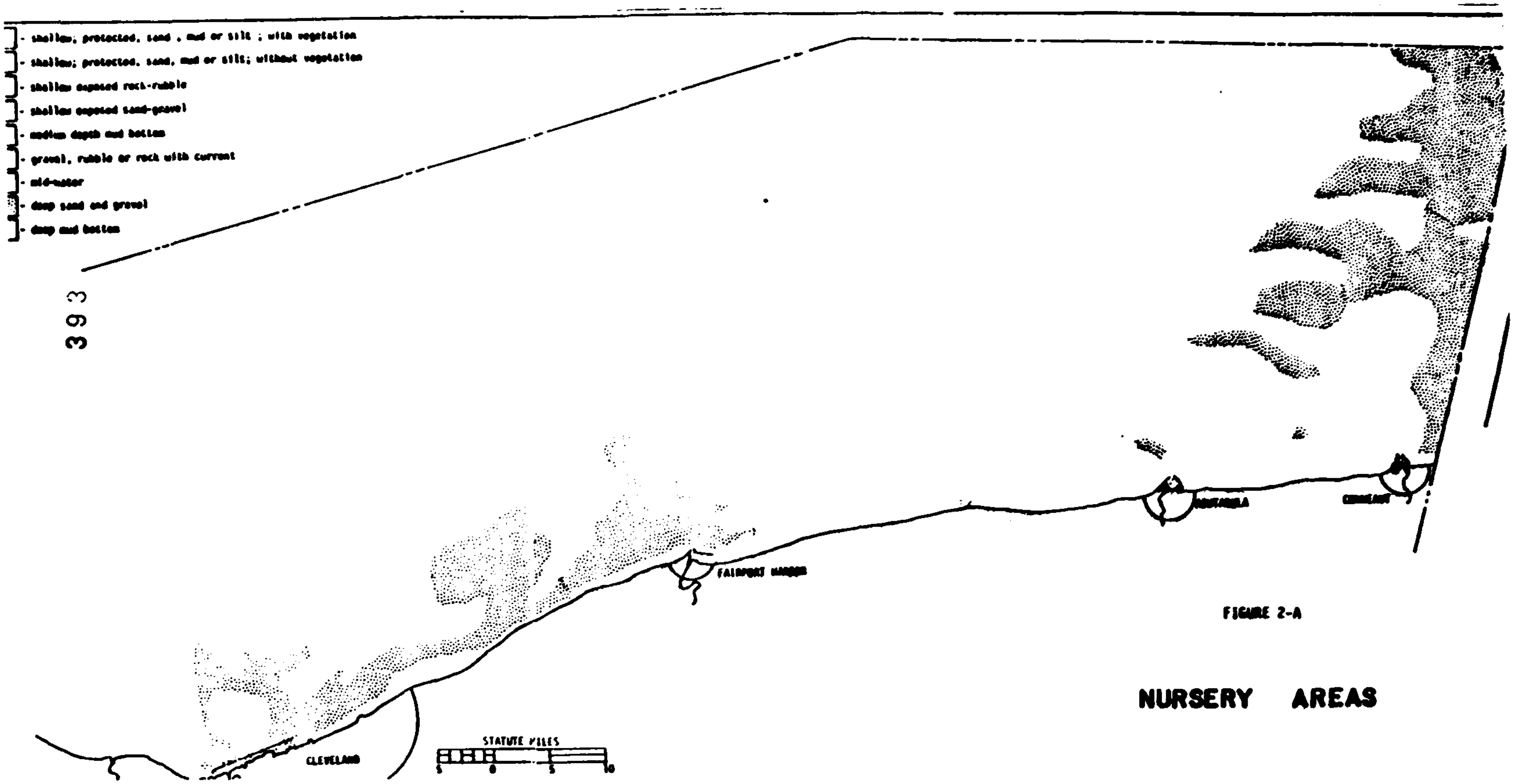
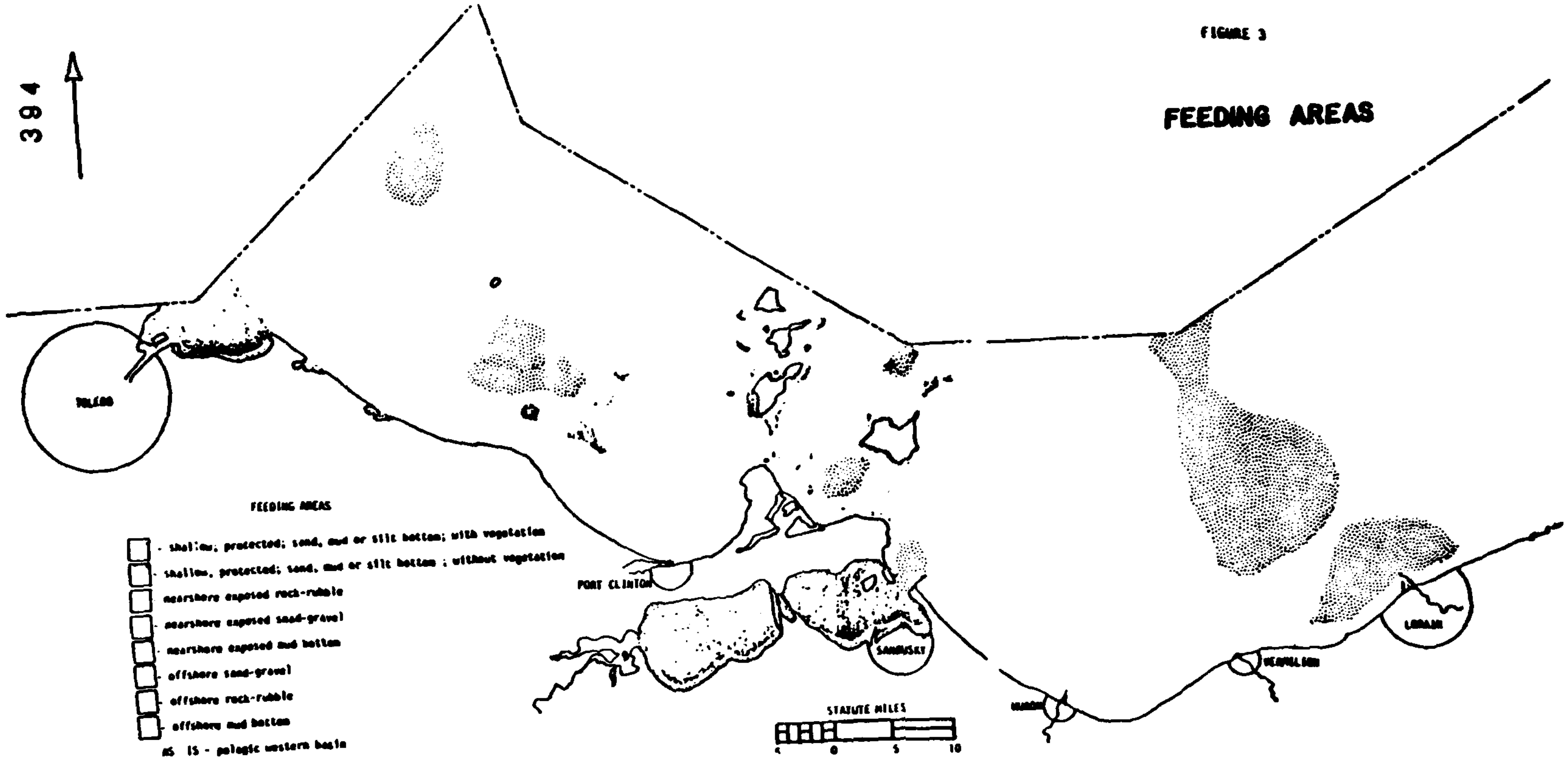


FIGURE 2-A

NURSERY AREAS

FIGURE 3

FEEDING AREAS



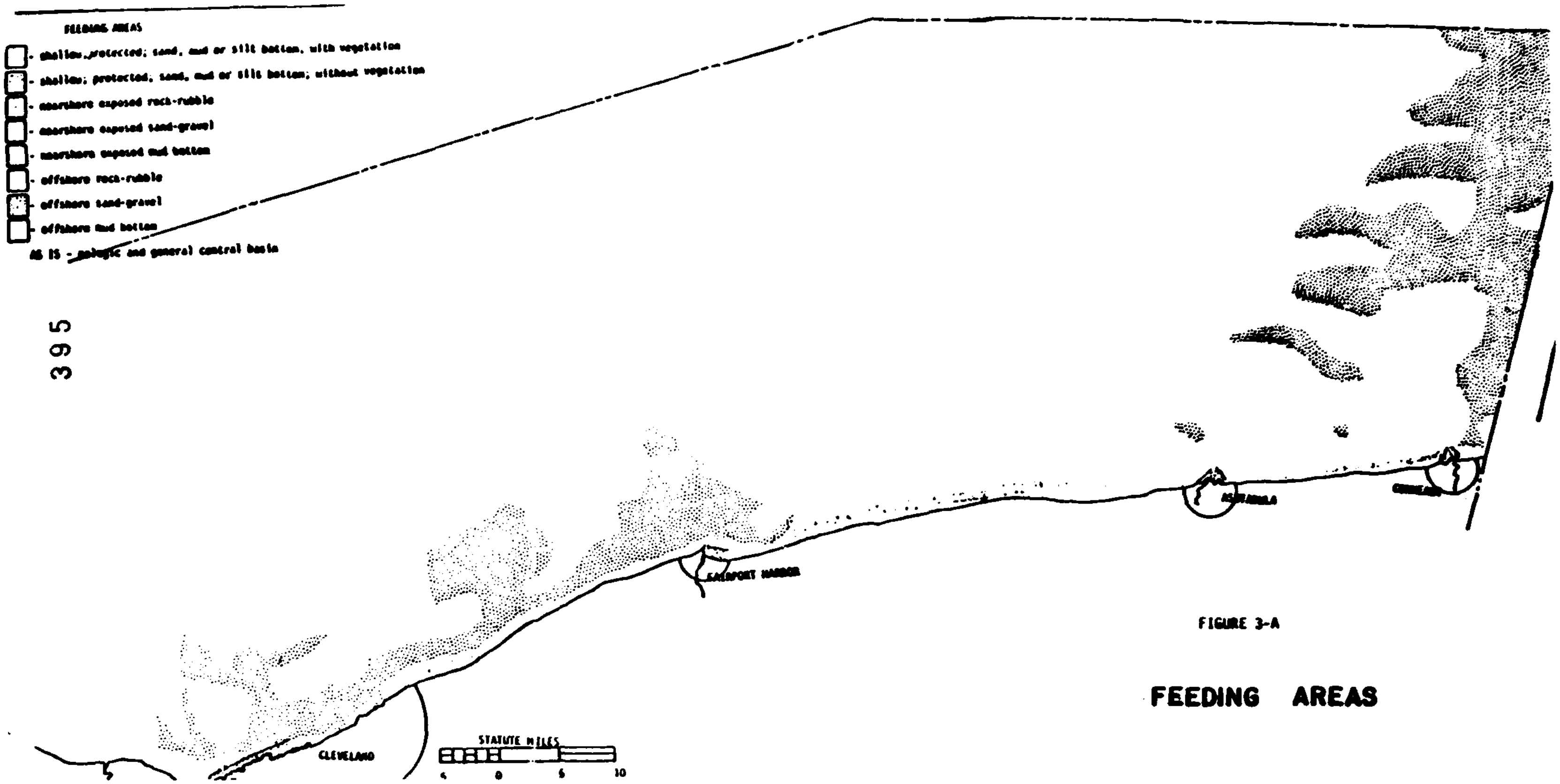
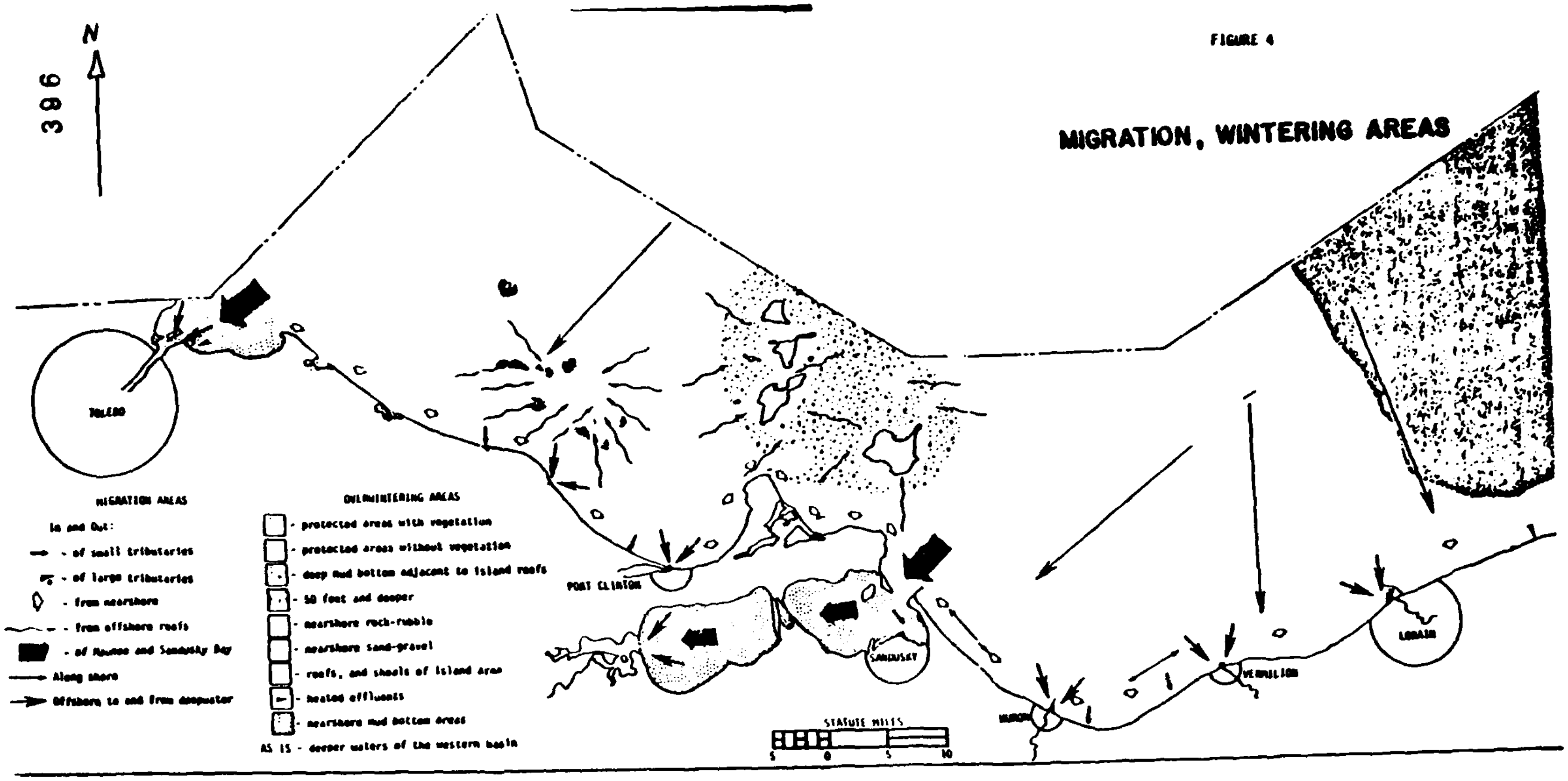


FIGURE 3-A

FEEDING AREAS

FIGURE 4

MIGRATION, WINTERING AREAS



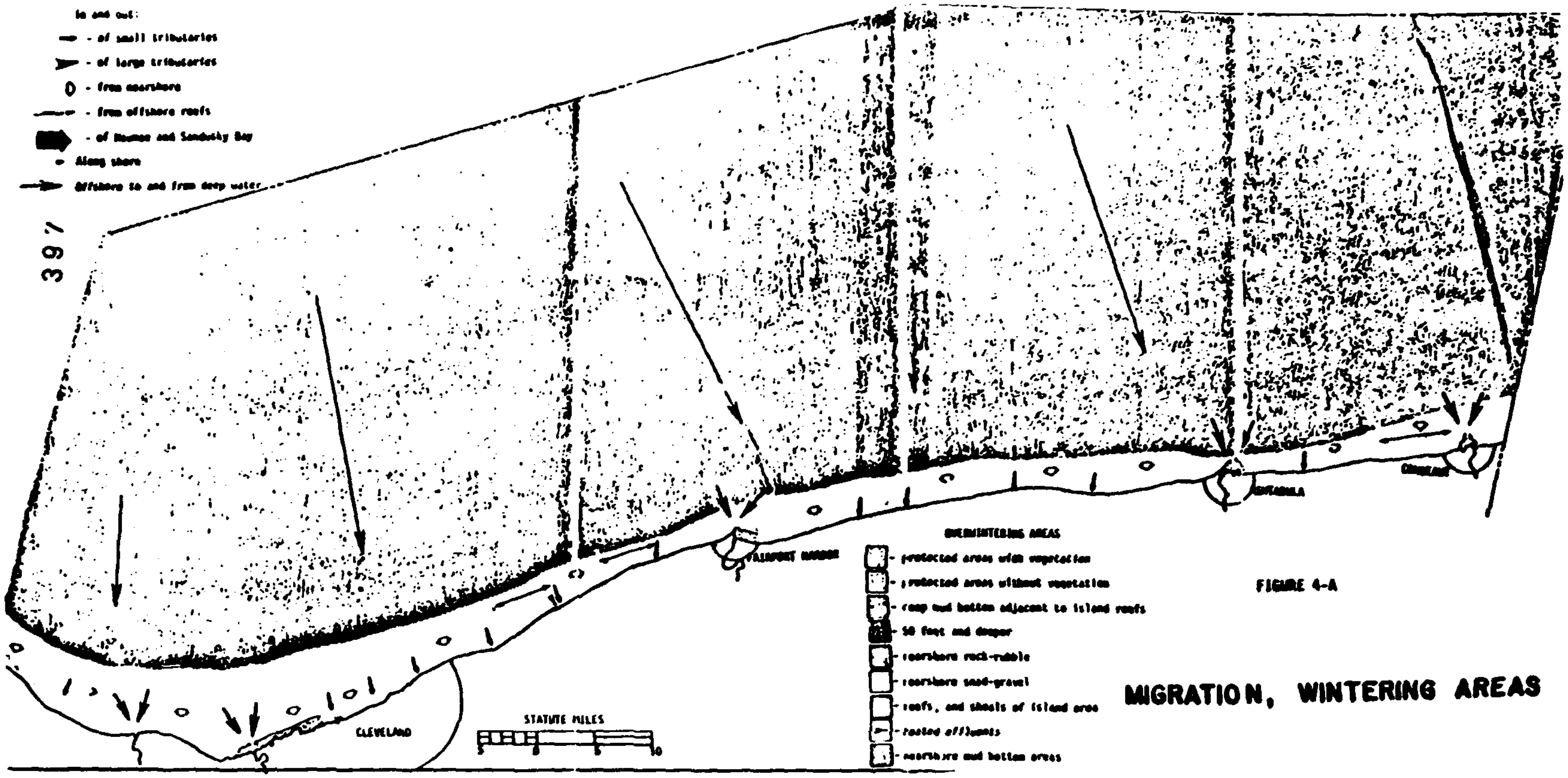


FIGURE 4-A

MIGRATION, WINTERING AREAS

the fishery programs is to restore an optimum balance between prey and high-value predator species and to manage these populations on a lake-wide basis. Management policies place high priority on the multiple-use concept of the fish population for both sport and commercial harvest.

Current management measures on Lake Erie include stocking of hatchery-reared fish, regulation of fishing, and habitat improvement and maintenance. Lake Erie receives plantings of rainbow trout, coho, chinook, and sauger. The merits of stocking striped bass is being investigated by various state agencies.

Species composition in the future depends on a large number of variables. Many species have shown drastic declines in numbers and/or distribution due to siltation, turbidity and loss of aquatic vegetation. These species are prime candidates for future extirpation. Some species of this type are the sand darter, channel darter, blackchin shiner, blacknose shiner, pugnose minnow, and brook silverside. If turbidity is reduced and if conditions stabilize, these species may come back. If anoxic conditions in the central basin improves, some increase may be seen in whitefish and burbot.

Sport and commercial species are projected to depend on improved management and population control as well as maintaining critical spawning and nursery areas. The yellow perch, walleye, and sauger are expected to maintain fairly

high populations along with high utilization pressure. Populations of freshwater drum are predicted to increase. Populations of other more eutrophic species such as gizzard shad, carp, and goldfish, are expected to remain stable or increase in the future. The Ohio Division of Wildlife believes that white bass and channel catfish populations will decrease from loss of spawning sites or migration routes due to siltation, dredging, spoil disposal, and shoreline modification. The white perch is expected to continue increasing in numbers and could become a major species for both commercial and sport fishing. The habitat use of Lake Erie in the future should be much as it is now with the main difference being the habitat lost to siltation, dredging, spoil disposal, shoreline modification and water quality degradation.

Management practices will probably continue to include stocking of hatchery reared fish, regulation of fishing, and habitat improvement and maintenance as well as stocking other possible species.

The sport harvest is projected to increase considerably due to tremendous increase of fishing pressure. Yellow perch, walleye, smallmouth bass, catfish and white bass are expected to receive increasing fishing pressure. Greater demands are also expected for coho and chinook salmon and possibly striped bass. Increases in the U. S. and Canadian commercial fish harvests will depend largely on shifting emphasis to lower value species, commercial fishing regulations, and management practices.

2. With the Project

The effects of vessel movement on fish in deep water during winter are not known, but are believed to be significant.

The following is a listing of various segments of the project with anticipated effects on the fishes of Lake Erie.

Icebreaking

Icebreaking will take place on the open lake, in harbors, and in bays. Effects are thought to be concentrated in nearshore areas, shallow bays and harbors. Propeller wash causes sediments to become resuspended displacing benthic organisms. Fish would be exposed to turbulent currents, causing additional stress. Loss of fishery resources would result from both effects.

Icebreaker Mooring Improvements

Additional icebreakers would need mooring facilities and pier space. An access channel may be needed between the navigation channel and the pier. The project/plan does not give enough detail to determine what resources may be affected. We assume that these mooring facilities will be located at or near existing Coast Guard facilities. More detailed discussions and recommendations are contained in the appropriate harbor sections of this report.

Ice Control Structures

Ice booms are proposed in Lake Erie at selected harbor entrances. A more detailed discussion will appear in the appropriate harbor sections. Ice booms do not appear to have significant effects on the fish resources. The anchors will be buried in the bottom and left in place. This could cause minor losses of habitat.

Air Bubbler Systems

The air bubblers, if operated as described in the proposed plan, should not have significant effects on the fishes of Lake Erie. Air pressures would not produce an air curtain effect because the jets are too far apart and the bubbles would not spread far enough to meet. Currents would probably not be strong enough to resuspend bottom sediments. The operating plan does not state whether the bubblers would be operated continuously or intermittently. There might be a local increase in dissolved oxygen levels. Other effects will be discussed in the appropriate discussion sections.

Dredging

Fishery resources of Lake Erie would be adversely affected by dredging of access channels for icebreaker mooring facilities. Placement of spoil could also cause adverse effects. A more detailed discussion of this development will appear in the appropriate harbor sections of this report.

Vessel Speed Control and Enforcement

This part of the plan could have a profound effect on fishery resources in the basin. Vessel speed is one of the factors controlling the pressure waves that can occur in confined channels. Several of these areas occur in Lake Erie, including the whole west basin, the shallow harbor approaches, and the Pelbe Passage area. Vessel speed (even if within the legal limit) has caused severe environmental damages in other parts of the system. Fishery resources have been eliminated directly and their habitat and food supply reduced. Without adequate vessel speed limits and enforcement at the above-mentioned critical areas, fishery resources could be severely affected.

Vessel Operating and Design Criteria

Presently there are ships operating in the Great Lakes which do not have the modifications outlined in the Coast Guard's operating and design criteria. Fishery resources and human lives are imperiled because ships have not been modified to include needed safety features. Strict requirements, incorporating these modifications for winter navigation, would reduce the chance of a major disaster.

Oil/Hazardous Substance Contingency Plans

The lack of compliance with the operating and design criteria causes the probability for a spill to increase.

Existing contingency plans are untried in winter. Several of the described contingency plan segments do not adequately protect fishery resources. The National Strike Team response time of four hours is inadequate for a spill in the flowing waters of the connecting channels. A spill could travel a long distance downstream in that time. The containment booms have not performed satisfactorily even under more ideal conditions than found in winter. Response time for the regional teams also is too long. By the time clean-up equipment is on the site, the spill can extend downstream or downwind a considerable distance. Fish habitat could be irreparable damaged. Fish eggs in the area would be destroyed. Spawning habitat could be made unusable even if fish eggs are not present. A spill also could destroy the benthic community since heavier petroleum products will sink to the bottom. Benthos are an important food source for fish. Existing capabilities do not appear adequate to prevent serious environmental damage.

Environmental Plan of Action

Much information concerning fishery resources is needed to make a more detailed and accurate evaluation of project impacts. Accurate fish stock assessments, spawning area surveys and other baseline studies are proposed in the EPOA. They will culminate in recommendations that will mitigate or compensate for the fish resource losses, if implemented. The EPOA will also provide for monitoring studies and will result in recommendations to eliminate or minimize adverse environmental impacts.

The project developments not listed above are not expected to have significant effects on the fishery resources of Lake Erie.

D. Wildlife

1. Without the Project

Lake Erie is an important migration area for various ducks, geese, swans, and other waterbirds. Waterfowl population surveys indicate more than one million ducks use Lake St. Clair and western Lake Erie during the peak of migration. The Long Point area of Lake Erie is especially important for diving ducks because of extensive beds of submerged aquatic plants that are intensively used by canvasback and redhead ducks. The western portion of Lake Erie has had an average of 60,000 ducks in early January, with most staying the entire winter. Spring migration starts in early March with as many as 20,000 diving ducks moving into the area. Wintering populations include sizeable numbers of canvasbacks and redheads. Whistling swans also use the marshes of Lake Erie during migration.

Shallow waters, shoreline marshes, and wetland areas are important nesting, resting, and feeding areas for many species of birds. In addition to waterfowl, these marshes and shoreline areas support large numbers of commercially valuable furbearers, namely muskrats, mink, and fox. Other important game animals in the Lake Erie area include the

white-tailed deer, cottontail, squirrels and ring-necked pheasant. An area of particular interest is the island area in western Lake Erie. A rookery of black-crowned night herons, common egrets, great blue herons, and green herons exists on West Sister Island which is a National Wildlife Refuge. Starne, Green, South Bass, North Bass, Ballast, and Gull Island Shoal, Middle Sister, East Sister, Big Chicken, Hen, and Pelee Islands are all listed as critical bird nesting and migration areas.

Waterfowl hunting in the open waters is largely limited to "layout" hunting and for the most part occurs within one mile of shore or the islands. Major hunting areas of this type are all of Maumee and Sandusky Bays and the entire south shore of the western basin between Port Clinton and Toledo. A large portion of the waterfowl hunting within the area is done from breakwalls, piers, dikes, and the shoreline. Major hunting areas exist at the few shoreline public hunting areas such as Metzger Marsh Wildlife Area, and the Magee Marsh Wildlife Area along the south shore west of Locust Point, and Willow Point Wildlife Area in Sandusky Bay.

Federal endangered or threatened species which may exist in the area are the Indiana bat, Kirtland's warbler, Arctic peregrine falcon, and the bald eagle (which nested on South Bass, Green, Kelleys, Rattlesnake, and West Sister Islands several years ago.) Two active bald eagle nests still exist along the Ohio shoreline of Lake Erie, one on Ottawa National Wildlife Refuge, and one near Oak Harbor.

Future wildlife conditions in the Lake Erie basin will change to some degree whether or not the Navigation Season Extension Program is implemented. In regard to future conditions in the Lake drainage, a number of assumptions have been made:

Wildlife species composition should remain similar to present conditions, with some fluctuations expected in relative numbers. Management practices are expected to continue in regard to hunting of migratory waterfowl and other game with possible increases in stocking (put and take) species like ring-necked pheasants. The harvest of all game species is dependent on populations and management practices. These are expected to remain constant. The status of endangered and threatened species are expected to generally follow present trends.

2. With the Project

Various operational measures considered necessary for extended season operation on Lake Erie could produce changes in the environment which would affect wildlife resources.

The following is a listing of the various segments of the project with anticipated effects on the wildlife of Lake Erie:

Icebreaking

Icebreaking will take place throughout the system. The effects are concentrated in nearshore waters, shallow bays and harbors. Propeller wash could cause currents which resuspend sediments and cause bottom scour displacing benthic communities used as food by wintering waterfowl and shorebirds. Icebreaking may also create open water areas which would attract and hold wintering birds.

Icebreaker Mooring Improvements

Additional icebreakers would need mooring facilities and pier space. An access channel may be needed between the pier and the navigation channel. The project plan does not give enough detail to determine what resources may be affected. We assume that these facilities will be located at or near existing Coast Guard facilities. More detailed discussions and recommendations are contained in the appropriate harbor sections of this report.

Ice Control Structures

Ice booms are proposed in Lake Erie at a number of harbor entrances. A more detailed discussion of these structures will appear in the appropriate harbor segments of this report. A small amount of open water may remain behind the booms. This may be attractive to waterfowl, but it will occur over relatively deep water and, therefore, be used only for resting. The anchors will be buried in the bottom and left in place. This could cause minor losses of bottom habitat and benthos.

Air Bubbler Systems

The air bubblers, if operated as described in the proposed plan, should not have a significant effect on wildlife resources, providing they do not create areas of open water. Bubblers, operated at low air pressures, would probably not resuspend bottom sediments. The operating plan does not state whether the bubblers would operate all the time or intermittently

Dredging

Dredging may be necessary for the proposed icebreaker mooring facilities. Both dredging of channels and associated spoil placement would affect wildlife resources.

Vessel Speed Control and Enforcement

This development can have a profound effect on the wildlife habitat within areas of pressure wave generation. The shoreline, wetlands and shallow water areas are particularly vulnerable to this phenomenon. Vessel speed is one of the factors governing the generation of these pressure waves. The areas where these waves can be generated include the whole western basin and shallow entrances to harbors. Excessive vessel speed has caused severe damages in other parts of the system. Wildlife habitat has been eliminated. Without adequate vessel speed limits and enforcement at the above-mentioned critical areas, wildlife habitat could be severely affected.

Vessel Operating and Design Criteria

As described in the fish section, there are ships presently operating on the Great Lakes which do not have the modifications outlined in the Coast Guard operating and design criteria. Wildlife resources, especially waterfowl, are particularly vulnerable and imperiled because these ships are not modified and are subject to a higher probability of accident. Strict requirements incorporating these modifications for winter navigation, would reduce the chance of a major disaster.

Oil/Hazardous Substance Contingency Plans

Existing contingency plans are untried in winter. Several of the described plan segments do not adequately protect wildlife resources, particularly waterfowl. The response times for the National Strike Team and the regional teams are too long. By the time the equipment is on site, the spill could extend a long distance, especially when carried by strong currents or driven by winds. Heavier petroleum products will sink to the bottom smothering benthic food organisms. Spring vegetation growth could also be affected by a winter spill. In addition to long response times, some cleanup equipment is less than satisfactory. More effective equipment should be obtained and strategically stockpiled throughout the basin.

Environmental Plan of Action

As was described in the fish section, the plan of action is designed to acquire information that will allow a detailed and accurate evaluation of project impacts.

The project developments not listed above are not believed to have significant effects on the wildlife resources of Lake Erie.

E. Discussion

Possible impacts of extending the navigation season have been mentioned in a qualitative manner, but information is not presently available to make quantitative predictions of the project effects on fish and wildlife resources.

Icebreaking activities and deep-draft vessel navigation on Lake Erie could result in sedimentation problems where water depths are shallow as in the western portion of the Lake and at harbors. Prop wash disturbance of bottom materials, along with scouring, turbidity and resuspension of toxic pollutants are realistic probabilities. This would have deleterious effects on benthic organisms, eggs and larval stages of some species of fish, and water quality.

Ship traffic could disrupt important ice fishing activities and access to fishing sites. A related safety hazard could be posed by unsafe ice conditions. Open vessel tracks could also disrupt or interfere with the cross-channel migration of mammals in local areas.

The effects of dredging for icebreaker mooring facilities at Toledo and Cleveland, Ohio, and Erie, Pennsylvania may cause disruption of fish migration and spawning, reduction in benthos production, mortality to fish eggs and larvae, and destruction of aquatic or terrestrial habitat from dredged material disposal. Sediments in the Lake Erie harbors are polluted and must be disposed of in an environmentally acceptable manner.

The Great Lakes' few sheltered open water areas with an adequate food supply are important to wintering waterfowl. Waterfowl from a widespread breeding area are concentrated in these and feed on small fish and benthos. If this food supply is depleted, they may be unable to find another protected area with adequate food. The nutritional state of migrating waterfowl in fall and early winter is very important. Reproductive success depends on adequate nutrition in the pre-reproductive period of spring migration. If fish and benthos are reduced by winter shipping, waterfowl reproductive success might be affected.

The impact of reduced benthos and fish life is not limited to fish and waterfowl. Gulls, terns, herons, grebes, ravens, cormorants, crows and terrestrial carnivores scavenge dead fish and actively pursue live ones. Gulls, terns, mergansers, grebes and cormorants absolutely require fish. The habitat of these waterbirds would be degraded by direct loss of fish or the benthos that many of the fish feed on.

The potential for elimination of benthos, fish, and wintering waterfowl from large parts of the harbors--or well beyond--seems greater from discharges and spills than from the mechanical

impact of ship passage. The impact of spills or discharges would depend on the quantity, timing, substance, weather, clean-up effectiveness and other factors involved. The loss of a year-class of small fish could seriously affect the ability of other fish as well as gulls, terns, cormorants and herons, to survive.

Spills and discharges are known to be harmful to fish and wildlife. Both internal (ingestion of contaminated food) and external factors result in increased mortality. For example, birds in the water at the site of petroleum spills lose both insulation and buoyancy, and unless only very lightly oiled, almost always die from hypothermia, drowning or poisoning. Even with the best available human intervention, a very low percentage of oiled birds survive.

Winter complicates clean-up efforts and a spill in or near a harbor would be expected to contaminate the shoreline. Oil, on the water or on shore, can affect bird populations. Recent research indicates that even small amounts of oil from a nesting bird's plumage can kill the embryos in eggs. Thus, even if the oil is not fatal to the individual bird, it could eliminate that bird's reproductive success.

Waterfowl congregate in harbors that have both open water and protection from wind and waves. At the same time, winter is a period of great stress due to scarce food supplies and increased energy requirements for body maintenance. Further stresses may result from the crowding of the flock and the unavailability of desirable habitat. In short, the birds wintering in the harbors are under a number of stresses in an undesirable (but best available) environment. Additional expenditures of vital energy will be required as birds flee oncoming ships. There will be additional forced movement to harbor and water areas where conditions are less favorable.

Whether this anticipated degradation of the environment for birds will be directly or indirectly harmful is not known. It is certain, however, that additional stress will have an adverse impact.

F. Recommendations

Recommendations applicable to Lake Erie proper are those listed previously for the Great Lakes Basin, Part F.

X. LAKE ERIE HARBORS

A. Monroe Harbor

1. Description of Area

Monroe Harbor lies on a coastal floodplain of the south bend of the Raisin River, a western Lake Erie estuary in southeastern Michigan. Located approximately 15 miles north of Toledo, Ohio, and 36 miles south of Detroit, this harbor is heavily influenced by the City of Monroe and its industrial development.

The City of Monroe is considered to be a developed city, although 52% of the land is not presently developed. A large portion of the vacant land is swamp and marsh land. The largest use of developed land (16.5%) is residential. Industrial uses constitute 12.2% of the land. The major portion of these industrial lands is concentrated along the Raisin River and is occupied by paper mills, the Ford Motor Company, the Port of Monroe, and the Detroit Edison Power Plant.

According to the 1970 census, the Monroe urban area (Frenchtown and Monroe Townships and the City of Monroe) accounts for approximately 40.2% of Monroe County's population of 119,215. Population projections for the year 2000 forecast a county population of 209,440 people with 54.2% expected to reside in coastal communities and 1.5% in the Monroe urban area.

The Raisin River flows in a general east-southeast direction, bisects the city, and outlets into Lake Erie. With

its tributaries, the Raisin drains approximately 1070 square miles of southeastern Michigan and a small portion of northwest Ohio. The width of the lower river ranges from 300 feet about two miles above the mouth to nearly 400 feet at the mouth in Lake Erie and for one mile upstream. Maximum and minimum discharge rates gauged 7.5 miles west of Monroe for the period of record (1937 to current year) are 12,900 cfs and 2 cfs, respectively. The entire flow of the river is diverted through the Monroe Power Plant for cooling water during most of the year. At these times, the water flow is reversed; lake water enters the river mouth and is discharged at Plum Creek down the McMillan Channel.

Survey sheets from the 19th century indicate vast areas of swamp and marshland were contained on the Raisin River floodplain. A new channel was dug on the northern edge of what is now the Detroit Edison site and a turning basin was created by excavation of the island formed during channel straightening. In 1930, the channel was widened and deepened, providing deep-draft access to the river.

The Monroe Port Commission owns approximately 600 acres of land on the south side of the Raisin River.

Property on Lake Erie on the north bank of the river is owned by Ford Motor Company. Detroit Edison's fossil fuel power plant is on lakefront property on the south bank of the river, the outfall of which is in an area once known as Plum Creek Bay Wildfowl Area.

Prior to industrial growth, the coastal wetlands at the mouth of the Raisin River consisted of 5,000 acres of marshlands. Approximately 89% of all wetlands in the Monroe area have been destroyed. Remnants of the famous Monroe marshes include Union Camp and Ford marshes. The State of Michigan recently purchased about 350 acres of this wetland for nature interpretation purposes. Ford Marsh is an unspoiled 230-acre marsh on the north side of the Raisin River. The marsh includes about 50 acres of American lotus, an aquatic plant listed as an endangered species in 1976 by the Michigan Department of Natural Resources.

Despite past and present abuse, the Monroe Harbor area still has outstanding fish and wildlife and recreational values.

Water quality surveys indicate that the Raisin River is an enriched stream with high coliform levels, especially in the harbor area. Concentrations of phenols, cyanide, and mercury have been found throughout the area. Water quality is improving in both the Raisin River and Lake Erie because of Federal and state water quality programs.

2. Description of Project

The recommended plan for Monroe Harbor is to install a 2000-foot air bubbler system along the wall of the turning basin near the Monroe Harbor terminal dock and a 2000-foot bubbler along the Detroit Edison Company dock near the river mouth. (Figure X-A-2-1). This will be accompanied by the assistance of an icebreaking tug on an "as-needed" basis to keep the harbor entrance channel open.

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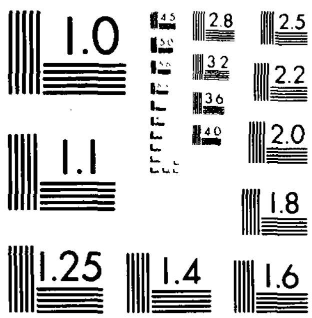

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

The bubbler systems consist of long perforated pipes, a supply pipe, and an air supply. Air pressure would be 10 to 15 psi. The air ports are to be about 20 feet apart. The bubbler would be operated to melt and reduce the thickness of ice. It would not keep the area ice-free nor create strong water currents.

3. Fish

a. Without the Project

The fishery of the project area is diverse. Forty-seven species have been recorded from the intake of the Monroe Power Plant and from other studies. Most of these species probably occur within Monroe Harbor and Raisin River. Lake trout have been taken offshore of Bolles Harbor in Lake Erie.

Fishing in the harbor and river is popular, particularly bank fishing. Perch, walleye, and bass are the more prized catches although carp, suckers, and centrarchids provide many man-days of fishing opportunity for residents of Monroe, Detroit and Toledo.

The Michigan Department of Natural Resources has constructed a fishway on a dam above the City of Monroe and has stocked Pacific salmon smolts in the Raisin River above the power plant. In 1977 coho salmon were planted in the river and the first runs are expected in the fall of 1978.

The fishery is heavily dependent on the benthos of the river, harbor, and lake. The benthic fauna consists mainly of burrowing organisms--oligochaetes, chironomids, and fingernail clams. Oligochaetes and chironomids are organisms which thrive in relatively polluted areas. The clams are classified as facultative organisms which survive in a wide variety of conditions.

The marshes provide food and spawning and nursery areas for numerous fish, especially yellow perch, white bass, and forage fish. Many adult fish move inshore to feed on vegetation, aquatic invertebrates, and smaller fish.

No species of fish appearing on the Federal endangered or threatened species list were reported. Muskellunge and burbot were reported in Edison's records, and these are classified by the Michigan Water Resources Commission as threatened in that part of Lake Erie.

Some fish management being conducted by the state includes the planting of anadromous species and the construction of a fishway.

The Monroe area fishery is expected to increase substantially with continued water quality improvements, the new fish structure, future planting of anadromous species, and improvements of the intake and discharge operations at the Monroe Power Plant.

b. With the Project

The impacts of the installation and operation of the two proposed bubbler systems and an ice-breaking tug are not known at this time.

Increased turbidity and erosion caused by prop wash under the ice may cause additional stress on an already stressed fish population Adverse impacts on marsh vegetation may also occur if vessel movements and propeller wash create ice uplifting and bottom erosion, sedminentation, and turbidity. Marsh vegetation frozen in the ice may be uprooted during the winter leaving the shore zone susceptible to erosion by wave action.

4. Wildlife

a. Without the Project

Wildlife habitat in the Monroe area consists of woodlands, brushland, wetlands, shorelines, and the aquatic environs of Lake Erie and its tributaries within the project area. Marshes provide the most valuable and productive wildlife habitat since they contain diverse and complex food chains controlled by water level fluctuations, light, temperature, and wave action. The marshes at Monroe are noted as major concentration areas of migratory waterfowl, serving as resting, nesting, and feeding areas for both the Mississippi and Atlantic Flyways. Waterfowl population surveys indicate that over one million ducks use western Lake Erie during the peak migration. Dominant species include the black duck, mallard, lesser scaup, ruddy duck, common goldeneye, common merganser, and coots. Moderate numbers of American widgeon are counted during migration. Canada and snow geese also use the wetlands for foraging and resting. Large numbers of overwintering waterfowl use the waters kept open by the thermal plume from

Detroit Edison. Mergansers, occur in the largest numbers; however, other species of both diving and puddle ducks are present. Mute swans from the Traverse City area also overwinter here. Approximately 100 great blue herons have been reported in the area during the winter months. The Monroe marshes alsc provide habitat for furbearing mammmals and spawning and nursery areas for fish. These wetlands also are used as feeding, shelter, and breeding areas by numerous shorebirds, songbirds, reptiles, and amphibians. Herons, egrets, bitterns, red-winged blackbirds, and belted kingfishers commonly use the marshes during the summer months.

A black-crowned night heron rookery once existed on Smith's Island in Plum Creek Bay. Although nesting by this species on the island has not been reported since 1972, the herons still visit the island during summer months. There is potential for recovery of this rookery.

Big game and small game resources in the vicinity include white-tailed deer, cottontail rabbit, ring-necked pheasant, ruffed grouse, gray squirrel, woodcock, mourning dove, and bobwhite quail.

The principal furbearing animals of the area are: muskrat, mink, beaver, weasel, raccoon, skunk, opossum, badger, red and gray foxes, and coyote.

Other species of animals found in the vicinity consist of woodchuck, crow, red squirrel, and raptors. The sandhill crane also migrates through the vicinity.

Wildlife appearing on the Federal endangered or threatened species list that may frequent the western shore of Lake Erie during migration are the American and Arctic peregrine falcons and Kirtland's warbler. The northern range of another species, the Indiana bat, is at Toledo, Ohio. The State lists numerous species which may be in the Monroe area.

Based on human population projections and on increased industrial growth in the Monroe area, wildlife habitat will probably be reduced. The threat of losing the remaining 10% of Monroe's original marshes continues. Prime wetlands such as Ford Marsh have been offered as disposal sites for polluted dredge spoils. A large number of waterfowl and shorebirds use Detroit Edison's existing fly ash disposal site between Plum Creek Bay and Bolles Harbor.

b. With the Project

More open waters in this area during the winter months may shortstop or influence more ducks and other aquatic birds to overwinter in this area. If the bubblers and icebreaking cause open water, this would have adverse effects. The number of waterfowl, primarily mergansers, presently using the Monroe area during winter is very high. Large concentrations of shortstopped waterfowl would be vulnerable to food shortages, potential oil spills, and discharges of other toxic substances.

In combination with the thermal outflow of the Detroit Edison Plant, the lakeward channel cut by icebreakers

may act to form a much larger open water area. Any alteration of the water currents may cause the area of the thermal plume to be shifted or enlarged.

5. Discussion

Fish and waterfowl habitat could be damaged or eliminated through bottom erosion, sedimentation, and turbidity due to propeller wash and possible pressure wave action. Benthic organisms could be eliminated by direct displacement and through smothering from the resuspended material. As with fish, wildlife food would be eliminated. This reduction, coupled with the possible increased shortstopping effect created by more open water, could create serious mortality in waterfowl.

If the bubblers did not commence operation until after a stable ice sheet formed, not as many waterfowl would remain in the vicinity. Vessel speed reduction in the shallow western basin of Lake Erie and in the harbor would reduce the possibility of vessel passage causing the destructive pressure waves.

Sport fishermen apparently maintain what they feel is a safe distance from the ship track and are reluctant to cross the track until shipping ceases. The vessel track should be marked to alert ice fishermen. This posting also should be done in the area where the bubblers operate.

6. Recommendations

The following recommendations supplement those listed previously for the Great Lakes Basin, Part F.

(1) Conduct studies to determine the effedts of the proposed bubblers and vessel movement in Monroe Harbor and in the approach to this harbor in Lake Erie. These studies should be coordinated with the appropriate agencies, both state and Federal. Some of the possible effects that should be included are: increased waterfowl over-wintering, loss of ice fishing area, increased fish entrainment at the power plant due to ice management, bubblers as attractants to fish and wildlife, increased turbidity, sedimentation, and bottom scouring, changes in fish distribution, and wetland degradation or destruction.

(2) Commence bubbler operation after stable ice has formed and operate the bubbler so that no open water is created.

(3) Areas of ice influenced by bubblers or vessel tracks should be clearly marked to warn winter recreationists of possible unsafe ice.

B. Toledo Harbor

1. Description of Area

Toledo Harbor ranks third among Great Lakes ports in commerical tonnage. The tonnage has steadily decreased from over 45 million tons in 1965 to 21.5 million tons in 1974.

The navigation channels of the harbor are approximately 25 miles in length, extending from the deep water, about 18 miles in Lake Erie, to a point about 7 miles upstream in the Maumee River, just downstream from the I-75 bridge. The lake navigation channel from the Maumee River mouth

out to deep water is 500 feet wide, and 28 feet deep. The river channel is 27 feet deep and 400 feet wide from the river mouth to mile 3 upstream. Figure X-B-11, from mile 3 to mile 6.5, has depths of 27 feet over a minimum width of 200 feet; and 25 feet deep over the remainder of the 200 foot channel width. Other dredged parts of the navigation channel include a turning basin of 35.6 acres opposite the terminal and railroad docks at the river mouth with a depth of 28 feet; a turning basin 750 feet wide, 800 feet long, and 20 feet deep at river mile 2.8; a semi-circular turning basin of 730 feet radius and 27 feet deep at river mile 6.5; and a turning basin of 8.25 acres and 18 feet deep at river mile 7 (the upper channel limit). Old open spoil banks form a discontinuous border along both sides of the lake channel from mile 1 to mile 6. Three old confined dredge disposal sites are located on the north side of the river channel between miles 1.6 and 2.7. A diked, island disposal site of 150 acres is located on the north side of the lake channel from mile 0.3 to mile 1.1. A new confined disposal site totalling 242 acres plus other confined disposal sites of more than 200 acres are located 355 feet southeast of the lake channel between miles 1.1 and 2.0.

Toledo Harbor lies in the mouth of the Maumee River, which drains an area of 6,586 square miles. The average flow is 4,794 cfs with a high of 94,000 cfs and a low of 20.0 cfs. Time-of-travel of the water through the Toledo area is as much as a month or more. During low-flow periods, reverse flow conditions at the river mouth often occur due to the intake of cooling water by the Toledo Edison Bayshore Power Plant. Toledo Harbor is very susceptible to extreme fluctuations in water level caused by wind set-ups and

seiches also causing reverse flows. Short-term fluctuations may be as great as 6 feet. The average annual fluctuation is approximately 1.2 feet. The highest monthly mean water level recorded was 576.58 feet. Low Water Datum (LWD) is 568.6 feet. Water depth of Maumee Bay is generally less than 6 feet below LWD. The lowest monthly mean water level recorded was 567.49 feet.

Water quality problems in Toledo Harbor include high bacteria counts, low dissolved oxygen levels, thermal loading, high turbidity, high nutrient concentrations, pesticides and toxic metals. These problems are related to organic or oxygen-consuming wastes created by municipalities, industries, and agricultural sources. Sediments contribute nutrients and pesticides to the degradation process. While the Maumee River contributes only about 2% of the water flowing into Lake Erie, it contributes about 25% of the sediment load to the lake (an average of 1.2 million tons per year). The sediments are mostly fine-grained silt and clay.

Cedar Point National Wildlife Refuge is located several miles southeast of the navigation channel. To the west, a large segment of the lake shore has been acquired by the State of Ohio for park development. The Maumee River is the second most important spawning river in the western basin of Lake Erie. Maumee Bay has been designated by the Ohio Department of Natural Resources as a critical fish habitat area.

2. Description of Project

The proposed plan recommends that Toledo Harbor be the location for a Type C icebreaker plus additional commercial icebreaking tug assistance. Mooring requirements include onshore storage space, a mooring pier, and an access channel between the navigation channel and the pier.

3. Fish

a. Without the Project

A diversified sport and commercial fishery exists in the Maumee River Basin. Anglers seek walleyes in March and April; white bass in April, May, and June; and channel catfish in June. Yellow perch are taken in large numbers in the river mouth and bay in the fall. Other fish in the sport catch include crappies, sunfish, bullheads, largemouth, smallmouth, and rock bass, northern pike, suckers, gar, bowfin, carp, drum and stonecat. Commercial fish landings in the Toledo area increased from 1.6 million pounds in 1968 to 2.9 million pounds in 1977. Fish reported in the commercial landings, in approximate order of decreasing poundage, include white bass, carp, yellow perch, freshwater drum, catfish, goldfish, suckers, quillback, bullhead, buffalo, and smelt. Other species in the river and bay include silver lamprey, sea lamprey, silver chub, troutperch, shiners, darters, gizzard shad, and alewife. The Maumee River is second only to the Sandusky River as a spawning and nursery ground supplying fish to the western basin of Lake Erie.

Without the proposed project, the species composition of the Toledo Harbor and surrounding waters will continue to change from one of high value species dominance to one of lower value species dominance. Species tolerant of increased turbidity (such as carp, goldfish, and orangespotted sunfish) will continue to prosper. Species requiring cleaner water, submergent aquatic vegetation and clean gravel or cobble bottoms (such as pike, gars, silver chub and smallmouth bass) will remain in low numbers or disappear. Sport fish such as walleye, smallmouth bass, and white bass will find fewer spawning areas. The nearshore, downstream areas will probably continue to be used as sport fish nursery areas, but may be further degraded.

Management practices will probably continue to consist of liberalized sport fishing regulations with continued or expanded restrictions to protect spawning fish in the upstream riffle section of the Maumee River. Commercial fishing will continue with possibly some increases in length limits on white bass and perch to allow more fish to reach spawning age before they enter the commercial fishery.

Sport harvest will continue to be high as sport fishing increases, particularly for the increasing walleye population. The sport harvest of white bass and perch may increase if length limit increases for the commercial fishery are instituted.

Commercial harvest will continue to be dominated by low-value species. If length limit increases for white

bass and perch are instituted, the catch may decrease for several years. However, total tonnage should eventually increase if anticipated population increases of the same species result from regulation changes.

The silver lamprey and the silver chub, considered to be endangered species by the State of Ohio, are still present in Toledo Harbor. The harbor does not contain any species listed on the Federal list of threatened or endangered species.

b. With the Project

If implementation of the extended navigation season leads to traffic increased in the Toldeo Harbor, increases in turbidity levels and transport of sediments may accelerate the rate of change in fish species composition. Species such as white bass and gizzard shad that are prone to winter stress may experience a considerable increase in mortality due to increased disruption caused by ice breaking and ship passage. Mortality increases may also result from fish being drawn to the Toledo-Edison Acme and Bayshore Power Plants and becoming entrained in the cooling water or impinged on the intake screens.

Mortality increases may also result from fish being drawn to the Toledo-Edison Acme and Bayshore Power Plants and becoming entrained in the cooling water or impinged on the intake screens.

Increases in trubidity and sediment transport in the harbor and bay area may lead to loss of remaining spawning areas. The use of the lower river and bay as a sport fish nursery area could also decline. Use of the area as an overwintering site for shiners and young-of-the-year white bass and gizzard shad may decrease due to increased disturbance from shipping activities.

Any reduction of spawning or nursery potential in the harbor or bay area would necessitate more protection of the remaining upstream spawning areas. This would be particularly true if spawning habitat became the critical limiting factor affecting certain sport or commercial fish populations in the bay area.

Sport harvest of white bass may decrease if young-of-the-year white bass overwintering in the bay experience increased mortality due to increased winter shipping traffic. Harvest of other fish may also decrease if increased turbidity and sediment transport reduce the carrying capacity of the bay area for sport fish.

Some decrease in the commercial harvest of white bass and perch might be expected if the changes previously mentioned are not offset by changes in length limit regulations. Rough fish harvest will probably not be affected and may constitute more of the total commercial catch if sport fish populations decrease.

4. Wildlife

a. Without the Project

Mammals found in the wetlands surrounding Maumee Bay include opossum, woodchuck, raccoon, skunk, weasel, mink, red fox, fox squirrel, and muskrat. Little terrestrial wildlife, except song birds and squirrels are found in the city. An abundance of furbearers in the wetlands of the western basin of Lake Erie supports a fur harvest in Ohio that ranks second in the nation. Maumee Bay and River comprise an important spring and fall resting area in the waterfowl migration corridor from Hudson Bay to the Gulf coast area. In winter, large numbers of ducks (scaups, mergansers, buffleheads, and goldeneyes) utilize the open bay waters. Federally endangered species thought to be incidental visitors to the area include the bald eagle, American peregrine falcon, and Kirtland's warbler.

The continuation of existing winter traffic from Toledo to Detroit should have little effect on the species composition of mammals. The species composition of waterfowl will also probably not change further in the area. Those species that are intolerant of disturbances may have already discontinued use of the area because of existing winter traffic.

Use of areas depending on cross-river movements over the ice cover would continue to be interrupted. Some disturbance of denning muskrats could continue to occur due to broken ice and resultant scouring of shoreline areas.

b. With the Project

Little change in the species composition of mammals would be expected unless the muskrat use of the area is seriously disrupted by projected winter traffic increase. Species composition changes of waterfowl may occur if increased vessel traffic causes some intolerant waterfowl species to avoid the area due to constant disturbance while at the same time attracting more tolerant ducks ducks to the open water.

The short-stopping of ducks in the open water areas may necessitate changes in management practices to reduce lamnutrition problems among the overwintering ducks. Harvest of waterfowl in the immediate area will probably not be affected as the hunting season is generally closed before significant lake ice forms. Thus, ducks would not be concentrated during the hunting season.

5. Discussion

This project is expected to degrade water quality through resuspension of polluted sediments and turbidity caused by vessel propeller wash and pressure waves. Dissolved oxygen problems could also be aggravated if cargoes of hazardous materials which have a high biochemical oxygen demand are spilled in the harbor. The Type C icebreaker mooring facilities are assumed to be located at existing Coast Guard facilities. The small Type C icebreaker is shallower draft so dredging an access channel may not be necessary in Toledo Harbor. The main adverse effects appear to be caused by

vessel passage and icebreaking. The probability of oil or hazardous substance spills is increased in winter and is of primary concern. These effects have been addressed in the Lake Erie portion (Section IX) of this report.

6. Recommendations

The following recommendations supplement those listed previously for the Great Lakes Basin, Part F.

(1) Investigate increased impingement and entrainment of fish and other organisms in the two power plants as a result of vessel passage disturbances.

(2) The relationship between vessel traffic and spills of hazardous materials in the Toledo Harbor and dissolved oxygen concentrations should be investigated by persons or agencies expert in water quality problems.

(3) If studies show that increased vessel traffic and/or accidental spills significantly lower dissolved oxygen levels in the harbor, a plan should be developed (in concert with the Ohio Department of Natural Resources, Environmental Protection Agency, and U.S. Fish and Wildlife Service to mitigate and/or compensate that effect.

C. Sandusky Harbor

1. Description of Area

Sandusky Harbor lies in the southeast portion of Sandusky Bay. The major inflow of water to the bay is from the San-

dusky River which has a drainage basin of 1,421 square miles. The maximum river flow is 28,000 cfs; minimum flow is 4.4 cfs; and the average flow is 1,021 cfs. Muddy Creek, Muskellunge Creek, Beaver Creek, Cold Creek, Raccoon Creek, Pickerel Creek, and Mills Creek also contribute water to the bay. The bay is about 17 miles long and has a maximum width of about 5 miles. The surface area is 25 to 30 square miles. The outflow from the bay enters the western part of the Lake Erie Central Basin. Water depths average 6 to 7 feet LWD. Johnson Island, located on the northeast side of the bay, is on the National Register of Historic Places.

Sandusky Harbor is protected by sand spits (Bay Point and Cedar Point) which form the narrow mouth of Sandusky Bay. The navigation channels consist of over 12,000 feet of channel, 400 feet wide and 26 feet deep extending from deep water to the harbor. Maintained channels in the harbor total about 25,250 feet in length with widths varying from 300 feet to 400 feet and depths from 21 feet to 25 feet. A 46-acre turning basin is also maintained.

The population of the City of Sandusky (1970 U.S. Census) was recorded at 32,674 with a total of 75,909 in Erie County. Projections for 1990 show 45,000 in Sandusky and 124,000 in Erie County. These predictions assume increasing industrialization. Shipping has remained fairly stable since the late 1960's with 5-7 million tons a year. Some 90% consists of coal and lignite exports to Canadian and U.S. ports. Shipments may decrease in the future if tighter air emission standards are adopted for coal-burning power plants.

Sandusky Bay receives pollution from its tributaries and the surrounding shoreline in the form of agricultural run-

off, industrial discharges, municipal effluents and sediment. Agricultural runoff and sewage effluent probably caused eutrophication of the bay waters. Sandusky now has a tertiary sewage treatment plant with a capacity of 15 million gallons per day. The plant is equipped with a phosphate removal process. Water quality is improving the bay, but dissolved oxygen and fecal coliform problems in the Sandusky River still persist.

2. Description of Project

The proposed plan for extended navigation season calls for a 1,000-foot bubbler at the northeast end of the coal loading dock and a high-power icebreaker tug (Figure IX-C-2-1).

3. Fish

a. Without the Project

Sandusky River and Bay probably are the most important sport and commercial fishery resource areas in the western basin of Lake Erie. The bay produces 30 percent of the commercial fish harvest in the State of Ohio. White bass, drum, channel catfish, bullhead, walleye, northern pike, and bluegills use the navigation channel as a migration corridor into the bay in the spring and out in the fall. Fish species that spawn successfully in Sandusky Bay in large numbers include yellow perch, crappies, bullheads, channel catfish, white bass, bluegills, gizzard shad, goldfish, carp, and drum. Fish utilizing the area to a lesser extent include largemouth bass, walleye, smallmouth bass, pump-

kinseed sunfish, rock bass, quillback, alewife, and longnose gar. Walleyes, sauger and white bass ascend the Sandusky River in the spring to spawn on the riffles near Fremont. Northern pike spawn in the marshy area in the southeast corner of the bay between the two causeways leading to Cedar Point. Sandusky Bay is the major commercial harvest area (in terms of pounds landed) in the Ohio portion of Lake Erie. In addition, the bay supports a large sport fishery. The summer fishery is concentrated in the eastern part of the bay. Sandusky Bay supports an estimated 5,000 man-days of ice fishing during suitable years. The ice fishing effort is distributed over the whole bay.

Changes in species composition will continue in Sandusky Bay even without the extended navigation season. Loss of spawning sites and habitat due to pollution, siltation, dredging, spoil disposal, and shoreline modifications will cause decreases of species such as walleye, perch, smallmouth bass and perhaps even white bass and catfish. Carp, goldfish, gizzard shad, and drum populations will remain stable or increase. Thus, the fishery will continue to move toward a dominance of low value, rough fish species over high value species. The rate of this shift will depend upon whether or not critical habitat areas are protected.

Habitat use in Sandusky Bay varies naturally with periodic long-term variations in lake water levels. Habitat use will also change as more areas are lost to siltation, filling, dredging, and other man-made modifications.

Management practices will probably follow the current trends of increased protection for spawning walleyes in the Fremont area. Increased length limits for commercially harvested white bass and perch are being considered by the Ohio Department of Natural Resources along with a quota basis for the commercial harvest of walleyes. Sport harvest will remain high as angling pressure increases. Possible changes in management practices may lead to increased harvest of white bass and perch. The harvest of drum will probably increase if more desirable species decrease in abundance.

Reduced commercial harvest is probable if length limit increases are approved for white bass or perch or if the walleye quota fishery is initiated. Harvest could increase if a larger market develops for low value species such as carp and drum.

The following fish species are considered endangered by the State of Ohio and may still occur in Sandusky Bay: silver lamprey, lake sturgeon, spotted gar, mooneye, Great Lakes muskellunge, lake chubsucker, silver chub, pugnose shiner, banded killifish, burbot, river darter, channel darter, and Iowa darter. No fish currently utilizing Sandusky Bay are listed on the Federal list of threatened or endangered species.

b. With the Project

The continual resuspension of sediments in the bay from ship movements and icebreaking as well as erosion from wind driven ice could accelerate changes in species

composition. Resuspension of sediments could hasten the deterioration of available spawning habitat and wintering areas. Due to the shallowness of the bay on either side of the navigation channel, the ramparting effect of ice breaking could form a barricade to fish movement. Winter navigation may accelerate the shift of dominance from high value to low value fish species in the Sandusky Bay area.

The potential increased rate of siltation of spawning areas would greatly reduce habitat values in the Sandusky Bay area.

The acceleration of a species composition shift from high value to low value species would necessitate the initiation of management practices to insure protection of remaining spawning populations of high value species in the area. Such practices as restricting fishing pressure during spawning periods or closure of spawning areas during spawning runs might be required. Commercial harvest of high value species in the bay area might have to be reduced or terminated.

Sport harvest may be reduced if the loss of spawning and overwintering areas for sport fish are lost. The harvest might also be reduced if fishing in the critical spawning areas is restricted. Harvest by ice fishing might be seriously curtailed by loss of fishing area due to unsafe ice conditions or disturbance of fish as a result of icebreaking activity.

Commercial harvest of high value species could be reduced if species composition changes occur as a result of initiation of winter navigation in Sandusky Bay.

4. Wildlife

a. Without the Project

Mammals common to the Sandusky Bay area include opossum, cottontail rabbit, woodchuck, fox squirrel, red squirrel, muskrat, red fox, raccoon, least weasel, long-tailed weasel, mink, skunk, and white-tailed deer. The bay area is an extremely important furbearer production area and is probably the most important migration and wintering area for waterfowl in the western Lake Erie Basin. Waterfowl in the fall migration corridors over Sandusky Bay number 250,000 to 500,000 diving ducks; 100,000 to 350,000 dabbling ducks, 25,000 to 75,000 Canada geese; and low numbers of blue and snow geese. Shorebird use is also substantial. Great blue herons, black crowned night herons, and egrets nest in the area. Some active bald eagle nests have been observed in the area. Several private hunting clubs maintain marshes on the west end of the bay for waterfowl hunting purposes.

Species composition changes will reflect a decrease in species such as least weasel, long-tailed weasel, and mink due to decreasing habitat and encroachment of developments. Waterfowl species composition will reflect areawide changes in population. Local nesting populations may change as a result of increased disturbances by man.

Habitat for furbearers and waterfowl will probably continue to be lost to recreational and residential development in the area. Much of the prime habitat is controlled by private hunting clubs and will probably remain undeveloped as long as hunting prospects are promising.

Management practices will probably change very little except to reflect any decreases in furbearer and/or waterfowl species populations brought about by loss of habitat to development of recreational and residential areas.

Harvest rates for furbearers and waterfowl will probably decrease slightly as some habitat is lost and populations decrease.

Species listed by the State of Ohio as endangered and which may occasionally be observed in the area but do not nest there include the sharp-shinned hawk, Kirtland's warbler, and the common tern. The king rail may nest in the area. The bald eagle and the Kirtland's warbler are included on the Federal Government's endangered species list. The Kirtland's warbler utilizes the area as migration habitat. The bald eagle is believed to nest in the bay area.

b. With the Project

Species composition of mammals will probably not change significantly due to winter navigation. Species composition of waterfowl during winter may change if open water is created by the project.

If open water causes appreciable increases in over-wintering duck and goose populations in the bay area, management practices may have to include methods to reduce malnutrition problems.

Harvest of furbearers and waterfowl in the Sandusky Bay area will not be seriously affected by an extended navigation season.

5. Discussion

The proposed project is expected to degrade water quality through resuspension of polluted sediments and turbidity caused by vessel propeller wash and possible creation of pressure waves. The bubblers would cause insignificant adverse effects if operated as proposed. Thus, the main adverse effects appear to be from vessel passage and ice-breaking. In Sandusky Bay these could be severe. The probability of oil and hazardous substance spills is of great concern. These effects have been addressed in the Lake Erie section (Section XI) of this report.

6. Recommendation

That Sandusky Bay be excluded from the Winter Navigation Program.

D. Huron Harbor

1. Description of Area

Huron Harbor is located at the mouth of the Huron River which drains approximately 403 square miles. The Huron River has a maximum flow of 25,800 cfs, a minimum flow of 2.2 cfs and an average flow of 296 cfs.

The project area is the entrance channel from Lake Erie to the mouth of the Huron River, which is protected by an east breakwater and a west breakwater pier about 4,973 feet in length. Channel width varies from 400 feet in the lake to 250 feet at the inner end. Depth is 25 feet in soft material and 26 feet in hard material. An enlarged turning basin has been provided within the river. The channel of the river has been deepened, widened, and maintained for a distance of more than a mile above the limits of federal improvement by owners of private terminal facilities.

Water quality in the harbor area is affected by the natural littoral drift and from agricultural, industrial, and municipal wastes discharged into the watershed. Data on bottom sediment quality in the harbor was collected in 1973 by U.S. EPA and found to be polluted landward of the Huron Light.

Old Woman Creek estuarine area, a unique and valuable area for fish and wildlife, is located 2 miles east of Huron, Ohio, and extends about 1 mile upstream. It consists of marshes, stream bed, and a 15 acre island within the marsh. The estuary provides excellent spawning habitat for such fish species as northern pike, bowfin, largemouth bass, black and white crappie, brown bullhead, and flathead catfish. It is utilized by both migrating and resident waterfowl.

2. Description of Project

The extended navigation season alternative proposes the construction of two 1,000- foot bubbler systems at inner harbor slip locations and 1,600 feet of ice boom located just northeast of the east breakwater extending due north to the edge of the navigation channel (Figure X-D-2-1). Huron Harbor is to have a commercial icebreaking tug located at the harbor.

3. Fish

a. Without the Project

Fisheries in the Huron area include: yellow perch, walleye, channel catfish, white bass, crappie, chinook salmon, bullheads, smallmouth bass, sucker, rock bass, goldfish, gizzard shad, freshwater drum, bowfin, stonecat, pumpkinseed, coho, alewife, and quillback. Surveys indicate 64 species of fish are found in the Huron River which maintains a high quality sport fishery and is the principal river in Ohio's salmon management program. Chinook and coho salmon are stocked in this river. Other migrating species in the river are smallmouth bass, white bass, and walleye. The greatest portion of fish production occurs upstream of the project area.

The project area provides feeding and nursery habitat for forage fish and a migration and feeding area for sport species. The harbor area is a nursery area for forage species and available habitat consists primarily of mud bottoms, vertical bulkhead walls, and vertical walled piers.

Lake shore anglers fished 85,000 hours in the Huron area during the summer of 1976. 40,000 hours were expended by boat anglers. The Huron area harvest consisted of 152,500 perch, 5,000 white bass, 5,000 freshwater drum, and 4,000 other species. Boat fishing is popular to the northwest and northeast of the harbor and the harbor's west pier is heavily used by the shore anglers. The period of greatest fishing activity is during the months of June, July, and August.

In the Huron area the commercial harvest in 1975 was about 82,200 pounds of yellow perch, 16,400 pounds of carp, 178,000 pounds of white bass, 127,500 pounds of drum, 13,500 pounds of channel catfish, and a total catch of 417,600 pounds overall.

The Huron River has not been classified as critical habitat for any fish species listed on the Federal Government's list of threatened or endangered species.

Species composition is expected to remain similar to the present while habitat use may increase with the abating of localized pollution. Coho and chinook salmon stocking programs are expected to continue and the Huron River is expected to remain the principal salmon management stream in Ohio. Harvest is expected to increase as a result of more fishing pressure.

b. With the Project

Conditions with the project are expected to remain similar to conditions without the project, with the

exception of the effects of increased turbidity, degraded water quality, and less habitat utilization. Ice boom anchor areas will be adversely impacted by immediate construction. The long-term adverse effects would be limited to increased stress on the total environment due to increased traffic and icebreaking.

4. Wildlife

a. Without the Project

Lake Huron is located on the eastern edge of the Mississippi Flyway and the western edge of the Atlantic Flyway. Common birds found in the area include mallard, black duck, teal, canvasback, scaup, goldeneye, bufflehead, oldsquaw, mergansers, great blue heron, horned grebe, common loon, ring-billed gulls, herring gulls, and various shore and wading birds.

Habitat in the project area is utilized mainly by resting and feeding migratory birds. Harvest is dependent on populations, hunting pressure, and regulations. Hunting pressure from the west pier is quite heavy.

Endangered and threatened species that may occasionally use the area are the Kirtland's warbler, the Arctic peregrine falcon, and the bald eagle. These birds are migrants in this area. The bald eagle may winter along the Lake Erie shore and occasionally visit the area.

Species composition, habitat use, and management practices are all expected to continue based on present

population trends. Harvest is expected to be dependent on many variables including hunting pressure, water quality, and wildlife populations. Some endangered and threatened species may experience increasing populations of effective pesticide controls and managment practices are implemented.

b. With the Project

Conditions with the project are expected to be similar to conditions without the project, with added stresses on wildlife resources stemming from increased traffic, sedimentation, and turbidity. There may be some adverse effects on wildlife species composition and habitat use in Huron Harbor from water quality degradation and disruption of feeding areas.

5. Discussion

The proposed project is expected to degrade water quality through resuspension of polluted sediments, turbidity caused by vessel propeller wash and creation of pressure waves. Proposed bubbler and ice booms would cause minor temporary adverse effects during installation. Their operation, if as proposed, would result in no adverse impacts on fish and wildlife resources which can be predicted at this time. The more predictable adverse effects appear to be from vessel passage, icebreaking and potential spills of oil and hazardous substances.

6. Recommendations

The recommendations for the Great Lakes Basin, Part F, should also be applied to Huron Harbor.

E. Lorain Harbor

1. Description of Area

The project area is situated on the south shore of Lake Erie, in Lorain County, at the mouth of the Black River. A 10,657-foot breakwater system forms a protected entrance and outer harbor area of 60 acres in size and 30-50 feet deep. The river channel is maintained to a depth of 27 feet to a point about three miles above the mouth. There is an upper turning basin 690 feet wide,17 feet deep and a lower turning basin 650 feet wide and 20 feet deep.

The Black River drains 467 square miles and has a maximum flow of 24,000 cfs. The average flow is 302 cfs.

Analysis of bottom sediments in the harbor by EPA indicate high levels of volatile solids, oil and grease, lead, zinc, and mercury--all exceeding present criteria for open lake disposal. The Black River is listed as one of the areas not meeting water quality objectives of the 1972 Water Quality Agreement and is mainly affected by municipal, industrial, and agricultural wastes. Due to the enlargement of the lower portion of the Black River, current velocities have decreased to such an extent that only limited amounts of sediments are transported into Lake Erie. The pollutants in these sediments are sufficiently concentrated to inhibit animal life and natural oxidation processes in the harbor area.

2. Description of Project

Alternatives as outlined by the Corps are listed as traditional, fixed and extended navigation season. The extended navigation season proposal calls for the construction of 6,800 feet of ice boom to protect the harbor mouth from wind-driven ice (Figure X-E-2-1).

3. Fish

a. Without the Project

Species composition in the Lorain Harbor area consists mainly of yellow perch, freshwater drum, white bass, gizzard shad, goldfish, spottail shiner, trout-perch, coho salmon, and crappie. Little information is available on the habitat use of the harbor area. Cover seeking species are expected to use the breakwaters and dock pilings while the pelagic species, like the white bass and gizzard shad, utilize the whole water area and do not seek cover. They are found throughout the harbor area. Coho salmon sometimes enter the harbor area to feed on small fish. Sport and commercial fishing regulations constitute the only known management practices.

Angling pressure is heavy during the spring and fall months with yellow perch, freshwater drum, white bass, and coho salmon the most sought after species. In 1976, sport harvest was about 103,000 perch, 1,000 walleye, 48,000 white bass, and 10,000 freshwater drum. Shore angling pressure in the summer of 1976 for Lorain area is reported as 135,000 hours. Boat angling hours are listed as 45,000 hours. The Lorain area commercial

catch for 1975 was reported as 95,500 pounds of perch, 50,400 pounds of drum, 15,000 pounds of white bass, 3,000 pounds of carp and 3,000 pounds of channel catfish.

b. With the Project

Future fisheries are expected to remain similar. Fish abundance and diversity may increase if water quality improves. Coho salmon populations will remain only if stocking of the species continues in the nearby Huron River. Sport and commercial harvests will depend on population trends and harvest regulations as well as water quality of the area. Project impacts are discussed in the Huron Harbor, Fish--Without the Project Section.

4. Wildlife

a. Without the Project

Because of the urban nature of the area, waterbirds are the major wildlife inhabiting the area. Lorain is located on the eastern edge of the Mississippi Flyway and on the western edge of the Atlantic Flyway. Common birds of Lorain Harbor area include mallard, black duck, teal, canvasback, scaup, goldeneye, bufflehead, oldsquaw, mergansers, great blue heron, horned grebe, common loon, ring-billed gull, herring gull, and other shorebirds and wading birds. Habitat in the project area is utilized mainly by resting and feeding ducks, gulls, and shorebirds. The west breakwater area is especially important to migrating waterfowl. Harvest is dependent on populations, hunting pressure, and regulations. The west breakwater is quite heavily used by hunters.

Endangered and threatened species that may occasionally frequent the area are the Kirtland's warbler, Arctic peregrine falcon, and northern bald eagle. These are not present in winter.

b. With the Project

Species composition, habitat use, and management practices are expected to continue based on present population trends. Harvest is expected to be dependent on many variables including hunting pressure, water quality, and wildlife populations.

5. Discussion

The proposed project is expected to degrade water quality through resuspension of polluted sediments and turbidity caused by vessel propeller wash, and possible creation of pressure waves. Ice booms would cause minor temporary adverse effects during installation of the anchors. Operation, as proposed, would not significantly affect fish and wildlife resources. The ice boom anchors would be left in place except for maintenance or if located in an area where they would be a menace to navigation (in the navigation channel). Thus, the main adverse effects appear to be from vessel passage and icebreaking. The probability of oil or hazardous substance spills is increased in winter and is of primary concern. These effects have been addressed in the Lake Erie portion (Section IX) of this report.

6. Recommendations

The recommendations for the Great Lakes Basin, Part F, should also be applied to Lorain Harbor.

F. Cleveland Harbor

1. Description of Area

The Cleveland Harbor area, protected by the breakwaters, is 5 miles long and 1,600 to 2,400 feet wide for a total area of approximately 1,300 acres. The main harbor entrance is 700 feet wide and improved and dredged channels are maintained in the lower 5.8 miles of the Cuyahoga River and the lower mile of the Old River. Depths range from 29-23 feet

The Cuyahoga River flows 102 miles in a "U" shape through northeastern Ohio. The lake approach channel is maintained at a depth of 29 feet. The outer harbor is 28 feet deep up to the mouth of the Cuyahoga River. The lower river is 27 feet deep up to the junction of Old River and 23 feet deep upstream to mile 5.8. The maximum flow of the Cuyahoga River is 24,800 cfs and minimum flow is 14.0 cfs.

In general, water quality deteriorates from west to east across the Cleveland area and improves with distance from the shore. The localized areas of water quality degradation are associated with sources of waste discharge near the mouth of the river and near wastewater treatment plants. Another area of depressed water quality is along the lake side of the east breakwater where dredge spoils were dumped

until several years ago. During the summer months and other low flow periods, the dissolved oxygen content of the Cuyahoga River in the lower reaches and pooled areas is zero. At this time, over eighty percent of the river's flow is inadequately treated domestic sewage.

2. Description of Project

The extended navigation season proposal will entail the construction of 4,800 feet of ice boom as the only modification needed to handle shipping through the winter. Three-thousand two-hundred feet of ice booms will be built 1,000 feet west of the west breakwater and extend straight north. A 1,600-foot boom will extend north from the east breakwater (Figure X-F-2-1). Mooring facilities are also needed for a B-type icebreaker. These facilities include onshore storage area, a pier, and an access channel between the navigation channel and the pier. We assume this will be located at existing Coast Guard facilities.

3. Fish

a. Without the Project

Diverse and abundant fishery resources occur within the Cleveland Harbor System. The Cleveland Breakwall and adjacent marinas are part of a major fish nursery along the lake Erie shoreline. About five miles of breakwaters and beach zones serve as spawning and nursery areas for perch and various forage species such as shiners, darters, dace and other cyprinids. Of the 107 fish species originally known to exist in the

region, 47 species can still be found within the harbor. Twenty-four species are known to reproduce at various locations in the harbor. Winter sampling indicated that of the 180 specimens of nine species collected, spottail shiner (50%), eastern gizzard shad (22.2%), rainbow smelt (13.9%) and emerald shiner (8.3%) were the most abundant species.

Little data exists on the sport fishery harvest in Cleveland harbor. It appears yellow perch, freshwater drum, carp, and white bass are the major species caught. Harbor fishing is substantial with an estimated angler use of 490,000 hours for the six-month summer season in 1975. Boat counts averaged about 10 per hour. Cleveland has one commercial fishing company. Yellow perch is the major commercial species landed and accounts for over 95% of the volume and value of fish taken. In 1974, a total of 306,275 pounds of fish were taken with a value of $110,278. The Lake Erie area just off Cleveland is one of the principal commercial gill netting and trap netting areas of the lake. Most of the boats are based in ports east of Cleveland resulting in the fish taken off Cleveland being landed elsewhere. The most productive commercial fishing periods usually occur between March and June. The lake area around Cleveland probably contributed over 1,000,000 pounds in 1974. Yellow perch are the major catch.

b. With the Project

Cleveland Harbor is expected to have improved water quality and increased fish populations in the future.

Species composition is expected to follow present trends with the possible comeback of more depressed species. Project impacts are also discussed in the Huron Harbor, Fish--With the Project section.

4. Wildlife

Wildlife of the project area consists mainly of birds. Approximately 260 species of birds have been observed in the Cleveland area during bird counts over the past 10 years. Bonaparte's, ring-billed, and herring gulls are especially common in the harbor area. Other birds observed at the harbor include the common loon, horned grebe, great blue heron, mallard, black duck, canvasback, goldeneye, bufflehead, oldsquaw, and common merganser. Large numbers of ducks are often attracted to the open water areas near power plants.

5. Discussion

The proposed project is expected to degrade water quality by resuspending polluted sediments. Turbidity caused by vessel propeller wash and pressure waves is also expected. Ice booms would cause adverse effects during installation of the anchors. Ice boom anchors would be left in place except for maintenance or navigation requirements. Thus the main adverse effects appear to be from vessel passage and icebreaking. The chance of oil, toxic material, or hazardous substance spills is increased in winter and is of primary concern. These effects have been addressed in the Lake Erie portion (Section IX) of this report.

6. Recommendations

The recommendations contained for the Great Lakes Basin, Part F, should also be applied to Cleveland Harbor.

G. Ashtabula Harbor

1. Description of Area

The outer harbor consists of a system of channels and a turning basin and encompasses an area of approximately 185 acres. The inner harbor is located in the lower 1.6 miles of the Ashtabula River.

The Ashtabula River drains approximately 136 square miles and has an average flow of 169 cfs. The Ashtabula River flows down the west side of the harbor and along the west breakwater into Lake Erie. Water levels do not fluctuate greatly with the wind, but wave action causes faster eastward longshore currents and contributes to a more rapid and widespread dispersion of contaminants and sediments. Seiches may temporarily alter current patterns in the harbor. Water depths in the project area are in the 30-foot range.

Ashtabula is included in a list of areas where pollution is a particularly critical problem. Highly polluted sediments come mainly from industrial wastes and agricultural runoff.

2. Description of Project

The extended navigation season recommended plan calls for a 7,200-foot ice boom to protect the harbor mouth from drifting ice (Figure X-G-2-1).

3. Fish

a. Without the Project

Gizzard shad is the dominant species during winter months. Coho and chinook salmon occasionally enter the harbor in winter to feed on of smaller fish. Protected areas of the harbor usually contain white bass, yellow perch, pumpkinseed, white crappie, goldfish and emerald shiner. The open waters of the harbor contain gizzard shad, carp, goldfish, yellow perch, brown bullhead, and emerald shiner, although these species are more abundant in more protected areas. Migrations of both lake and stream species to and from lower sections of the Ashtabula River may alter the species composition of the harbor. Anadromous salmonids, yellow perch, white bass, freshwater drum, suckers, catfish, silver lamprey, sea lamprey, and smallmouth bass will enter the river if water conditions are favorable.

Aquatic habitat is largely mud-bottomed with little suitable cover. The lower portion of the Ashtabula River provides somewhat more sheltered habitat. The rock riprap of the harbor breakwaters provides cover and protection for fish.

Sport fishing pressure in the area during 1976 consisted of about 15,000 shore angling hours and 15,000 boat angling hours. Approximately 12,000 perch and 12,000 freshwater drum were caught during the summer.

Commercial harvest for Lake Erie (in the Ashtabula area) consisted of 108,882 pounds of yellow perch, 70 pounds of freshwater drum, 7 pounds of carp, 99 pounds of white bass, and 2 pounds of catfish in 1973. The 1974 catch included 141,877 pounds of perch. There is an excellent outlook for both commercial and sport fishing in the area.

The future without the project will most likely be similar to the present fishery with possible increases in the populations. If pollution is cleaned up, species numbers may increase. Agricultural erosion stabilization and pollution abatement could significantly improve fishery habitat.

b. With the Project

The future with the project will almost certainly mean increased vessel traffic during winter months with accompanying resuspension of sediments and toxic materials such as heavy metals, phenols, hydrocarbons, and phosphates. Fish populations would decline due to the additional stress during the winter time. This could result in a shift in species composition and habitat use. Sport and commercial fishing would decline due to the population decline.

4. Wildlife

a. Without the Project

Wildlife of the project area consists largely of waterfowl and shorebirds. The urban nature of the area precludes most species of terrestrial wildlife. Ashtabula Harbor is located on the eastern edge of the Mississippi Flyway and on the western edge of the Atlantic Flyway. Great numbers of diving ducks such as scaup, goldeneye, mergansers, redheads and canvasbacks, as well as numerous dabbling ducks such as mallards, teal, black duck and pintails use the harbor area. Some Canada and snow geese also utilize the area for resting. Some other birds common to the Ashtabula Harbor include great blue herons, old squaws, Bonaparte's gulls, ring-billed gulls and herring gulls. The main use of the project area is for resting and feeding.

b. With the Project

Additional resting areas for birds behind ice booms could result from the project.

5. Discussion

The effects of open water created by ice booms and the increased stress caused by traffic, noise, turbidity, sedimentation and icebreaking need to be addressed. Other effects that need special consideration are spills and contingency plans for their containment and cleanup.

Ice booms do not appear to have significant effects on fishery resources. A small amount of open water may remain behind

the ice booms. This may be attractive to waterfowl. However, the booms are located over relatively deep water and could be used only for resting. The anchors will be buried in the bottom and left in place. This could cause minor losses of habitat.

Icebreaking would cause bottom habitat damages from propeller wash resuspending sediments and causing turbidity. Sedimentation and turbidity would affect the benthic community and aquatic vegetation beds. A reduction in vessel speed would reduce this disturbance to some degree. Other effects, such as noise from icebreaking, are suspected to impact fish and wildlife resources and need to be studied.

6. Recommendations

The recommendations for the Great Lakes Basin, Part F, should also be applied to Ashtabula River.

H. Conneaut Harbor

1. Description of Area

Conneaut Harbor has a breakwater-protected outer harbor and an inner harbor consisting of the lower half-mile of Conneaut Creek. Some small craft recreational facilities are located just west of the mouth of Conneaut Creek.

Conneaut Creek has a drainage area of 191.2 square miles. Over 85% of the watershed is rural. At the mouth, the maximum stream flow is 17,000 cfs, minimum flow 0.2 cfs, and

an average flow 252 cfs. The lake influence extends about 3,000 feet upstream from the mouth, the upstream navigable limit. Conneaut Creek does not have sufficient water depths to allow commercial vessels upstream of mile 0.5.

Water quality in the lower portion of Conneaut Creek is affected by agricultural runoff, industrial wastes, urban runoff and the municipal sewage system outfall. The city of Conneaut has a secondary sewage treatment plant which empties into Conneaut Creek about 1/8 mile from the mouth. Rural runoff, the principal source of sediments entering the harbor, results from surface erosion of intensely cultivated, fine-grained soils in the Creek's upper watershed.

2. Description of Project

The extended navigation season alternative proposes the construction of 7,600 feet of ice boom. A 5,220-foot boom would be built perpendicular to the harbor mouth approximately 1,000 feet from the end of the breakwaters. A 2,400-foot boom would extend out from the east breakwater about 1,000 feet inshore from the outside boom (Figure X-H-2-1).

3. Fish

a. Without the Project

Fishery surveys conducted in July and August 1975, indicated the presence of rock bass, smallmouth bass, hog sucker, common sucker, bluntnose minnow, common shiner and creek chub. Smelt, walleye and gizzard shad may also occur in the creek. Trout and salmon

return to spawn during April and November, respectively. Conneaut Creek provides potential living and/or breeding habitat for such species as the emerald shiner, spottail shiner, bluntnose minnow, longnose dace, smallmouth bass, pumpkinseed sunfish, rock bass, black crappie, log perch, spotfin shiner, big-eye chub, river chub, shorthead redhorse and channel darter. The latter four species are considered endangered by the State of Ohio. Management practices include sport and commercial fishing regulations and the stocking of about 30,000 steelhead in Conneaut Creek.

Sport fishing in the Conneaut area was about 25,000 angler-hours for the summer of 1976 while boat angler hours were 40,000. Harvest of 28,587 perch and 8,500 freshwater drum were reported. Commercial harvest for 1975 was broken down into 18,000 pounds of yellow perch, 616 pounds of white bass and 76 pounds of channel catfish. Conneaut Harbor is still the site of a small fishing fleet. Eight vessels were operating out of the harbor in 1971 and are still economically important to the area.

b. With the Project

Ice booms are proposed at the Conneaut Harbor entrance. No long-term adverse impacts should be associated with their installation. A small amount of open water may remain behind the booms which could be attractive to waterfowl. However, these booms would be located over relatively deep water and the open water behind them could be used only for resting. The anchors will be buried in the bottom and left in place. This should cause only minor losses of habitat.

Icebreaking and vessel passage would cause bottom habitat damages from propeller wash causing resuspension of sediments and turbidity. Sedimentation and turbidity would damage the benthic community and aquatic vegetation beds. A reduction in vessel speed should reduce this negative impact somewhat. Icebreaking noise may scare fish from their preferred habitats. This aspect of Winter Navigation must be studied prior to development of inaccurate impact assessment and or mitigative measures.

4. Wildlife

a. Without the Project

Waterfowl, herring and ring-billed gulls overwinter in open waters in and near Conneaut Harbor. Canada geese, whistling swans, shorebirds and songbirds also pass through the area. Snowy owls are known to inhabit the breakwater area during the winter.

Wildlife utilizing the undeveloped area south and east of the harbor area include ruffed grouse, woodcock, woodpeckers, hawks, owls, red and gray fox, red, gray and fox squirrels, chipmunk, opossum, woodchuck, meadow vole, muskrat, skunk, and white-tailed deer.

Federally listed endangered bird species that may visit or nest in the area include the Kirtland's warbler, American peregrine falcon, and bald eagle. Wildlife species in the area considered endangered by the State of Ohio include the common tern, upland sandpiper and spotted turtle.

b. With the Project

Projected future use with the project should be basically the same with the exception of possible increased resting area for birds because of ice booms and resulting open water.

5. Discussion

The effects that need to be addressed are the open waters created by the ice booms and the effect on the migration and distribution of waterfowl and fish, increased stress on fish and wildlife caused by increased traffic, noise, turbidity, sedimentation and icebreaking. Other effects that need special consideration are the possibility of oil and hazardous substance spills and their effects on surrounding area and contingency plans for their containment and cleanup.

6. Recommendations

The recommendations contained in Section II. Great Lakes Basin, Part F, should also be applied to Conneaut Harbor.

I. Erie Harbor

1. Description of Area

Erie Harbor serves Erie, Pennsyvlania, an industrial city with a population of about 136,000. The harbor is located on the south side of the bay formed by the Presque Isle Peninsula. Presque Isle State Park is located on most of the peninsula north of the harbor.

The harbor, turning basin, approach channels and entrance channel offer the standard Great Lakes depths. The rest of the bay is relatively shallow. It appears that many of the past developments in this harbor are in need of repair. The harbor does not receive much traffic.

Land use around the City of Erie is predominantly agricultural and urban. Some woodlots still exist. The Presque Isle peninsula consists of a sand spit overlain with a soil layer. Sand beaches and marshland are interspersed along shores of the bay and lake. Cascade Creek and Mill Creek enter the harbor area of the bay.

The water quality in the harbor is degraded by industrial and municipal discharges. There are several heated discharges, some with differential allowances of up to 45°F above ambient. Water quality has improved recently. The bay bottom is considered polluted. Both Cascade and Mill Creeks are also heavily polluted.

2. Description of Project

The developments proposed for Erie Harbor include the installation of three 1000-foot bubblers (Figure X-I-2-1). They would be located along the Port Commission dock, the Erie Marine, Inc., dock and the Continental Grain Company dock. In addition, a Type C icebreaker would be stationed here. We assume that mooring facilities including dockside storage area, mooring dock, and a dredged access channel would be needed. A privately-owned icebreaking tug would be hired in the harbor on an as-needed basis.

3. Fish

a. Without the Project

Presque Isle Bay and the adjacent portions of Lake Erie provide good to excellent habitat for a wide variety of fish including rainbow trout, rainbow smelt, muskellunge, smallmouth bass, largemouth bass, walleye, coho salmon, northern pike, crappie, yellow perch, rock bass, white bass, sunfish, sheephead, carp, suckers, and many forage fishes such as gizzard shad, emerald shiner, and other minnows. The wetlands and beds of aquatic vegetation along the north shore of the bay provide excellent spawning and nursery areas for many of these fish. The secondary bays and indentations also offer high quality fish habitat along the State Park area. These areas also have relatively large benthic communities indicating that this area is not as polluted as the harbor portion of the bay. Ice fishing in the northern part of the bay is popular. No figures for ice fishing are available.

There is no commercial fishery in Presque Isle Bay or in this part of Lake Erie.

b. With the Project

The operation of three bubblers is not expected to alter the fish species composition in Presque Isle Bay. All bubblers are located adjacent to docks and will not affect spawning or nursery areas. Water depths in the harbor are such that propeller wash of a loaded ship may resuspend some polluted sediments. Currents should deposit the material in the southern part of the bay minimizing impacts. The icebreaker mooring facilities are assumed to be located in the harbor area. Damages from dredging an access channel should be minimal. Polluted spoil should be placed in an impermeable disposal site. The vessel track would not cut access to ice fishing areas nor would vessel passage affect ice fishing in the bay.

4. Wildlife

a. Without the Project

Waterfowl, shorebirds, wading birds, and urban wildlife can be found in this area. Squirrels and songbirds comprise most of the wildlife. Waterfowl migrating in the Atlantic Flyway use Presque Isle Bay as a resting and feeding Presque Isle State Park is listed on the National Natural Registry. Waterfowl hunting is allowed by special permit after the recreation season. Because of the ice-free areas, some waterfowl winter in the area. Wetlands and aquatic vegetation beds

offer good feeding habitat during ice-free times, but ice cover precludes their use in winter. Thus, the fish and benthic communities supply these wintering waterfowl with food. The waterfowl wintering in the area include mallard, scaup, goldeneye, bufflehead, and merganser. Many gulls winter in the area feeding on the gizzard shad that are attracted to the open water areas.

Some furbearers also inhabit marshes in the bay. These include muskrat, mink, raccoon, and skunk. Except for duck hunting by special permit, no hunting, fishing, or trapping is permitted in the State Park.

It is not presently known whether any threatened or endangered species use the area during winter. It is likely that bald eagle, American peregrine falcon and Kirtland's warbler, all on the Federal endangered species list, are incidental visitors to the area.

b. With the Project

The waterfowl, shorebirds, and furbearers in the bay during winter should not be significantly affected by the proposed developments. Some adverse impact would result from bubblers if the areas are ice-free.

Oil is among the commodities entering Erie Harbor during winter. An oil spill could be disastrous in Presque Isle Bay. Both fish and waterfowl habitat would be destroyed or degraded. Wintering waterfowl, gull and raptors, fish, fish eggs, and benthic organisms could be killed both directly and indirectly.

5. Discussion

The draft survey report indicates that Erie Harbor winter commercial vessel traffic is expected to be light. Aside from the icebreaker, vessel movement will be minimal and would be less of a threat to fish and wildlife resources. The bubblers would be operated at low pressures and intermittently. No open water is anticipated.

The main risk involved with winter navigation in this harbor is the probability of oil spills either at the oil docks or in the harbor. Either case could be disastrous. This is especially true under ice conditions due to long response times of spill containment teams, lack of nearby storage of equipment and materials, lack of local people trained to help in the containment and cleanup and the ineffectiveness of gear presently used in containing spill. The shipment of oil in winter should be prohibited until an environmentally acceptable spill contingency plan has been demonstrated.

These comments were developed without benefit of field surveys. Environmental studies should be planned and implemented so that the valuable fish and wildlife resources are safeguarded. These studies should include the gathering of baseline information and monitoring of winter navigation developments.

6. Recommendations

The following recommendation supplements those listed previously for the Great Lakes Basin.

(1) Develop a comprehensive spill response plan that includes the training of local personnel, the stockpiling of spill and cleanup supplies, and wildlife scaring devices; and the identification and securing of suitable space and food sources for cleaning and rehabilitating contaminated birds.

J. Buffalo Harbor

1. Description of Area

Buffalo Harbor serves the City of Buffalo in Erie County, New York. There are approximately 1.3 million people in the vicinity, with the city itself containing over 500,000. Buffalo is located on the eastern end of Lake Erie at the juncture of the lake and the Niagara River. This area is the western terminus of the New York Barge Canal. Black Rock Channel and the Tonawanda Harbor downstream on the Niagara River also are in the area.

This area is highly industrialized. Waterborne commerce consists primarily of iron ore, limestone and grain. Annual traffic averages about 13.5 million tons. Manufactured products and oil are also landed.

The harbor facilities can accommodate ships with drafts of 27.5 feet (project depths for the system). The south entrance has depths of 30 feet. The harbor is protected from the lake by a series of breakwaters with openings at both ends. There are many ship canals extending off the main harbor area. Much of the shipping moves through these channels.

Water quality is poor in Buffalo Harbor. As far back as 1928, the need for pollution abatement was stressed. Industrial, domestic and agricultural wastes and heated effluents add to the problem. Ice is usually not a problem in the Harbor because of the warm water effluents.

2. Description of Project

The plan for Buffalo Harbor proposes a 4,800-foot ice boom to close off the north entrance of the harbor (Figure X-J-2-1). The south entrance would be the only access to Lake Erie. The boom would be the heavy duty type (double steel tanks with anchors). Anchors could be any one or combination of types including "mud anchors", "H" anchor and buried concrete. The plan also proposes the use of a privately-owned icebreaking tug. The tug would be used to break ice to the dock on an as-needed basis. Icebreaking on Lake Erie would be furnished by the breakers stationed at different locations around the lake. The nearest large icebreaker would be stationed at Cleveland and the nearest smaller breaker at Erie.

3. Fish

a. Without the Project

The Lake Erie fishery adjacent to Buffalo Harbor contains a variety of fish which are described in the Lake Erie segment of this report (see Section IX).

Waters in the Buffalo area of Lake Erie support populations of smallmouth bass, northern pike, walleye,

largemouth bass, muskellunge, brown trout, rainbow trout, coho salmon, sheephead, yellow perch, assorted panfish, and bullhead. Forage fish include carp, suckers, gizzard shad, and assorted minnows and other smaller fish. Muskellunges are taken in the Niagara River area downstream from Buffalo Harbor.

Because of the polluted nature of the harbor waters and bottom, the area provides limited habitat for fish. The benthic community also is limited. Species present may include carp, bullhead, and yellow perch. No information is available on Buffalo Harbor fishes.

b. With the Project

The ice boom and the icebreaking tug are not expected to alter the fish species composition in Buffalo Harbor or in Lake Erie. Neither the harbor nor lakefront contain fish spawning and nursery areas. The benthic community is limited because of pollution. Thus, vessel traffic and icebreaking would not cause significant damages in the harbor area from propeller wash and pressure waves even though polluted bottom materials may be resuspended.

4. Wildlife

a. Without the Project

Because of the urban and industrial nature of the area, wildlife resources are limited. Species include songbirds, grey squirrels, fox squirrels, cottontails and

raccoon. In addition to these terrestrial species, waterfowl, shorebirds and wading birds inhabit the harbor area and the adjacent lake. Populations of these birds are moderate to low. Most waterfowl are diving ducks including greater scaup, ringneck duck, redhead, canvasback, and mergansers. As many as 20,000 scaup are known to winter in the area.

b. With the Project

The ice boom closing the north entrance of the harbor would not affect wintering waterfowl. The boom may have a small amount of open water behind it, but when compared to the amount of open water due to the thermal effluents, the area is insignificant.

Vessel passage and icebreaking would not affect waterfowl since these activities would be confined to the harbor area. Should pollution in the harbor be reduced or eliminated, the resulting rehabilitated habitat would be used by waterfowl.

5. Discussion

Accidental spills of oil, hazardous materials, and toxic substances could have disastrous effects on wintering waterfowl and shorebirds. Winter complicates cleanup efforts and a spill could contaminate shorelines. Spills may also adversely affect benthic organisms. This impact would be especially severe since it would reduce forage for wintering diving ducks.

6. Recommendations

The following recommendation supplements those listed previously for the Great Lakes Basin.

(1) Develop a comprehesive spill response plan that includes the training of local personnel, the stockpiling of spill and cleanup supplies and wildlife scaring devices; and the identification and securing of suitable space and food sources for cleanup and rehabilitating contaminated birds.

XI. LAKE ONTARIO - BASIN

A. Description of Area

Lake Ontario is the fourth largest of the Great Lakes and ranks 14th in size among the freshwater lakes of the world. The lake has a total surface area of 7,340 square miles, is 193 miles long, 53 miles wide and has an average depth of 283 feet (LWD). The maximum depth is 802 feet. The United States portion of the lake covers 3,460 square miles. Some 85 percent of the inflow is from Lake Erie via the Niagara River. There are no major diversions out of the Lake, and outflow through the St. Lawrence River averages about 239,000 cfs. The St. Lawrence carries the discharge to the Atlantic Ocean approximately 557 miles to the northeast.

The Lake Ontario Basin is the smallest of the Great Lakes with only 13,340 square miles of land surface in the United States. The drainage of the United States portion of the basin lies essentially within the State of New York. A very small area

of the drainage basin is located within Pennsylvania. The principal United States tributaries are the Niagara River, the Genesee River, the Oswego River, and the Black River.

The Lake Ontario Basin is the last in the Great Lakes' drainage system and, therefore, the lowest in water level elevation - 242.8 feet. The difference in mean surface level between Lakes Erie and Ontario is approximately 326 feet. Relief in the basin, which includes the Adirondack Mountains, is the highest in the Great Lakes.

A wide variation of sometimes complicated topographic features exists. The level plain around the edge of the Lake gives way to rolling, glaciated topography. The uplands are plateaus or glaciated hills with steep slopes. Streams near the headwaters are fast-moving and cold, with high water quality. Farming is restricted to localized areas of suitable soils, second-growth forest cover remains elsewhere.

There are many glacial features throughout the basin. In contrast to the Upper Great Lakes Basin areas, glaciation of the Lake Ontario area involved less extensive deposition of material, thus leaving a more rugged landscape. Bedrock exposures are common in the basin. Groundwater resources are moderate to poor in much of the Lake Ontario Basin due to the dominance of either the fine-grained or igneous bedrock formations.

An indistinct sill that runs north of Rochester, New York, separates Lake Ontario into two basins. The eastern basin, encompassing approximately 10% of the Lake's surface area, is relatively shallow and contains numerous islands and shoals. Only a small portion of the central-western basin contains islands, shoals,

and protected bays. The configuration of the basin reflects the structural attitude of the Paleozoic strata which dip to the south. Because of the differential erosion of the southward dipping beds, the floor of the lake drops gently away from the north shore and abruptly away from the south shore.

Cliffs of varying heights make up the shoreline of Lake Ontario. The bluffs are interrupted by embayments (drowned valleys of streams which fed into Lake Ontario when it was at a lower level). Many embayments have bay head or bay mouth sand bars. Along most of the shore, beaches are poorly developed.

The pH of Lake Ontario is approximately 8.4 and is influenced by the carbonate system in the Lake. The concentrations of ions such as sodium, calcium, sulfate, and total dissolved solids are higher than in any other Great Lake because much of Ontario's input is from the other lakes. It also receives many pollutants from its own drainage basin.

Lake Ontario is changing from an oligotrophic to a mesotrophic lake as ion concentrations and total dissolved solids continue to flow in from Lake Erie and other runoff sources. It has not reached the level of eutrophication found in Lake Erie because of its deep average depth. This depth in relation to surface area is a major factor in the Lake's overall productivity. It never produced a commercial fishery comparable to the Upper Great Lakes.

Lake Ontario was the first Great Lake to be settled and explored by white men. Consequently, most problems that have appeared on the upper lakes have already been present on Lake Ontario for some time. Alewife and sea lamprey, for example, were well-established in Lake Ontario before 1900.

The factors that determine the climatic character of the Lake Ontario Basin are the presence of large bodies of water, Lakes Erie and Ontario, the existence of relatively high mountains in and adjacent to the eastern reaches of the basin, and prevailing winds from the west in the summer and from southwest to northeast in the winter. As these winds pass over Lakes Erie and Ontario, they absorb considerable moisture which is deposited as precipitation. The mean annual precipitation ranges from about 32 inches along the lakeshore to about 52 inches in the eastern portion of the basin. The annual average snowfall is approximately 64 inches along the shoreline and 128 inches in the northeastern portion of the basin. Mean daily temperatures range from about $17^{o}F$ to $25^{o}F$ in January, and from $78^{o}F$ to $84^{o}F$ in July. Extremes may be $-55^{o}F$ and about $100^{o}F$.

The Lake Ontario region is largely rural, with over 50 percent covered by forests. Small towns and rural communities dot the entire region, except the eastern highlands. Over 70 percent of the population lives in nine counties making up the Rochester, Syracuse and Utica-Rome, New York Standard Metropolitan Statistical Areas. Fruit, vegetable and dairy production are of major importance, along with localized areas of diversified manufacture and industry. Tourism, with sport fishing a major component, is one of the most important industries along Lake Ontario. Most shoreline communities are dependent on tourism associated with lake recreation. New York State, local governments, and private interests have developed a number of parks and beaches, marinas, and fishing access areas to accommodate tourists. Lake Ontario today offers unlimited potential for the expansion of sport fishing opportunities.

There are Federal harbors at Rochester, Great Sodus Bay, and Oswego. Major commodities at Rochester include exports of coal to Canada and imports of cement from Canada. No commerce has been reported at Great Sodus Bay in recent years. Traffic at Oswego consists of receipts of cement and shipments of fuel oil.

B. Description of Project

As a result of improvements in selected harbors of Lake Ontario, which will be discussed separately, additional icebreaking and vessel traffic on the lake itself are anticipated. Areas in which significant icebreaking will be required include Lake Ontario from the Welland Canal to the head of the St. Lawrence River, and vessel tracks to Rochester and Oswego Harbors. Additional icebreakers will be added to the Coast Guard fleet, and will require new mooring facilities at Rochester and Oswego. These may necessitate new dredging projects.

The operational measures proposed for implementation for extended season operation on the Lake Ontario portion of the system are:

Icebreaking Requirements

Icebreaking will be required on the main lake, at harbor entrances in the harbors and rivers. The several ice forms include sheet ice, drift ice, and pancake ice. The sheet ice generally requires more energy to break, except when the drift ice has windrowed. The icebreakers will be of two types, the deep draft heavy high-powered polar type and the smaller shallower draft lower-powered Type C breaker. In addition, powerful icebreaking tugs will be used in the harbors. Two icebreakers would be stationed at Rochester and Oswego, respectively. An icebreaking tug will be used at Cape Vincent to take the pilots on and off the ships.

Icebreaker Mooring Improvements

The icebreakers would need additional mooring facilities made up of some lands for storage area, pier space and possible dredging of an access channel. In some locations, additional facilities are not needed. Specific locations and detailed plans were not included.

Vessel Traffic Control

The method of keeping track of the vessels in transit will be through an existing series of pre-selected check points. Traffic control is designed to prevent collisions, rammings, and groundings. The vessels will check in with a traffic center. This will not directly affect fish and wildlife resources in Lake Ontario.

Ice/Weather Data Collection/Dissemination Systems

An Ice Navigation Center was established for the Demonstration Program. This center receives and disseminates information on ice conditions, weather, and other information to the ships. This will not affect the fish and wildlife resources.

Aids to Navigation

These developments include the use of Loran C and a system of navigation lights, beacons, and radar reflectors. No additional aids to navigation are presently needed in Lake Ontario.

Ice Control Structures

These structures are the proposed ice booms. Ice booms are floating logs or metal cylinders chained together and anchored to the bottom. The anchors will be left in place, but the floats will be removed in spring and put back in fall. In Lake Ontario a structure will be placed at Oswego Harbor entrance to keep the drift ice from jamming the entrance and making it impassable.

Air Bubbler Systems

Air bubbler systems are not currently proposed for Lake Ontario or any of the harbors.

Lock Modifications

The Welland Canal, owned and operated by the Canadian Government, is not included in the Navigation Season Extension Program. It is not known at this time when or how the canal will be modified for extended season navigation.

Power Plant Protection

No power plant protection is presently proposed in Lake Ontario.

Dredging

The dredging proposed for Lake Ontario winter navigation includes that needed in the harbors of Rochester and Oswego to accommodate Type C icebreakers. Nothing in the plan describes what is to be done with the spoil generated. Most, if not all, dredging would be accomplished in the harbors where polluted spoil may

be present. Dredging would include excavating deep draft channels from the regular navigation channel to the mooring facility. If the spoil is determined to be polluted, it must be deposited in confined spoiling areas which allow no runback into the lake or other receiving water.

Compensating Works

This project is currently proposed for St. Clair-Detroit Connecting Channel. The Lake Ontario plan of development does not include compensating works.

Shoreline Protection

There presently are no proposed shoreline protection measures for the Lake Ontario area. However, further studies may indicate the need for shoreline protection in some areas, especially in the eastern portion of the lake.

Island Transportation Assistance

Island transportation assistance is not required on Lake Ontario.

Connecting Channel Operational Plans

The operational plans for the downstream connecting channel, the St. Lawrence River, will be discussed separately.

Water Level Monitoring

Water level monitoring will be carried out on the Niagara and St. Lawrence Rivers and in the Welland Canal and not on Lake Ontario proper.

Vessel Speed Control and Enforcement

This planning development proposes that the U. S. Coast Guard is responsible for the control and enforcement of vessels and their speed. Vessel speeds vary from 0-15 miles per hour. The monitoring of these speeds has been with the Doppler method, but new electronic gear on the ships allows vessel operators to more easily comply with speed limits. The Coast Guard presently sees no need to change speed limits because damages to shoreline structures and shoreline erosion are the responsibility of the vessel operator. The determination as to causes of damage is the Coast Guard's. Alternative means of protection are being studied.

Safety/Survival Requirements

The requirements and developments will not affect the fish and wildlife resources.

Vessel Operating and Design Criteria

These criteria have been developed to promote safe vessels and operation in all United States waters. For vessels operating in ice, the criteria are explicit about hull strength, power plant, strengthened steering mechanisms, special propellers, and other specific gear. There also are special criteria for vessels transporting oil and hazardous substances. If complied with, all of these will reduce the probability of accident and serious spills. These criteria are the responsibility of the vessel owners and at his option. Vessels are operating and will continue to operate without them in winter. No additional regulations or enforcement are currently proposed.

Search and Rescue Requirements

These requirements will not affect fish and wildlife resources.

Oil/Hazardous Substance Contingency Plans

The Coast Guard is the designated responsible agency for oil and hazardous substance contingency plans on the Great Lakes. These plans include one stockpile of materials located at Cleveland, to be used to contain spills. An Interagency Regional Response Team also exists and the Service is a member. The National Strike Force, a highly trained Coast Guard unit organized for oil spill containment, has a four-hour response capability in the Great Lakes area. The cleanup of a spill is contracted out to companies specializing in this activity.

Vessel Waste Discharge (Nonhuman) Requirements

These requirements and standards have been set and enforced by the U. S. Environmental Protection Agency. These requirements include the equivalent of secondary treatment. No wastes are to be discharged into the waters of the lakes. The problems of disposing of these wastes in special harbor facilities are being studied and recommendations will be forthcoming.

Environmental Plan of Action

The following discussion assumes that navigation season extension will not be implemented on the St. Lawrence River. Should navigation season extension be implemented on the St. Lawrence River, the additional impacts on the resources of Lake Ontario would have to be evaluated by the Fish and Wildlife Service. One possible impact which has already been identified would be

water level changes resulting from project modifications and ice cover disturbance on the St. Lawrence River. However, major water level impacts on Lake Ontario resources are predicted only if winter navigation is implemented on the St. Lawrence River. This impact is more fully developed in the discussion of water level impacts on the St. Lawrence River.

Pilot Access

This development will not be used on Lake Ontario. It is to be used on the St. Lawrence River and will be described as a part of the river.

Channel Clearing Craft

This development is being studied by the St. Lawrence Seaway Development Corporation. The device has not been designed. The purpose will be to remove mush ice from the vessel tract so that it will not float downstream to concentrate or jam-up. Since adequate information is not available, this development cannot be evaluated. The channel-clearing craft will not be used on Lake Ontario, but will be employed on the St. Lawrence River.

C. Fish

1. Without the Project

Lake Ontario phytoplankton levels are generally moderate-to-low with inshore populations declining from the western to the eastern end of the lake. Planktonic algae are the primary producers of organic matter in the lake and are more abundant near shore than in open areas. Phytoplankton

development exhibits a biomodal pattern of development in Lake Ontario. This pattern does not break down as it frequently does in Lake Erie (indicating Erie's eutrophic condition).

Growth of Cladophora and rooted aquatic plants have greatly increased in the last decade and are becoming a nuisance. Their growth, however, is limited by suitable substrate and the depth of light penetration. Cladophora, for example, requires a rocky substrate. Thus, it is found in a discontinuous band around the entire Lake Ontario shoreline.

The eastern part of Lake Ontario is 1.7 times richer in planktonic crustaceans than the central-western basin. Some species appear in the eastern portion of the lake and expand westward while others, though evenly distributed, concentrate in deep water. The Lake also supports a very large population of Mysis, or so-called opossum shrimp, which can form dense swarms.

On balance, Lake Ontario supports an excellent overall zooplankton forage base. In addition, the forage fish base, dominated chiefly by alewives and rainbow smelt, is considered equal to or better than that of Lake Michigan on a per acre basic.

The bottom fauna is qualitatively uniform throughout the lake and is comprised of six principal organisms. The dominant forms (95% of all organisms collected) are scuds, Pontoporeia affinis, and to a lesser extent oligochaete worms. Sphaeriidae (fingernail clam), Chironomidae (bloodworms), Isopoda (aquatic sow bugs), and Hirudinea (leeches)

comprised the remaining 5 percent. The predominance of the amphipod, Pontoporeia affinis, in offshore areas indicates that Lake Ontario's benthos is more similar to that of the Upper Lakes than it is to Lake Erie.

Shallow areas, or about 10 percent of the Lake, support nearly 100 percent of the sport and commercial fisheries. The remainder of the Lake supports an unknown amount of fish life.

Fish collections acquired from Lake Ontario during 1972 and 1973 revealed the presence of 65 species in the lake. Several of these species (e.g., alewife, gizzard shad, brown trout, carp, goldfish, rainbow trout, rainbow smelt, white perch, sea lamprey, and three-spine stickleback) have been introduced in the last 150 years. Since 1900, seven species (lake trout, shortnose cisco, bloater, kiyi, burbot, blue pike, and fourhorn culpin) have been drastically reduced in number or may have become extinct. The blue pike is presently on the Federal Endangered Species list.

These changing fish populations indicate the present instability in the lake's ecosystem. A combination of factors including overfishing, eutrophication, urbanization or surrounding areas, and degradation of spawning areas have induced this instability.

The commercial fishery yield on Lake Ontario does not approach the magnitude of Lake Erie yields. In fact, it is valued at less than $100,000 per year with production at less than 2 million pounds.

Historically, however, eastern Lake Ontario, bays, and harbor areas have supported a significant warmwater sport fishery that has been, and is, the backbone of local economics. Since 1968 a new, significant, and popular salmonid sport fishery has developed.

The lake trout, once native to Lake Ontario was completely gone by the late 1940's or early 1950's. Today, due to the cooperative efforts of the New York State Department of Environmental Conservation, U.S. Fish and Wildlife Service, and Ontario Ministry of Natural Resources, through the international Great Lakes Fishery Commission, lake trout are once again abundant and thriving due to intensive management and sea lamprey control since 1972-73. Lake trout now in Lake Ontario are the fastest growing of any in recorded literature. In addition, within the past 7 years one of the finest brown trout sport fisheries in the world has been developed, while New York and Canadian tributaries to the Lake today provide excellent steelhead-rainbow trout fishing.

At the time of earliest settlement, Atlantic salmon were plentiful. Heavy fishing pressure, plus construction of dams on the spawning tributaries, resulted in steady fishery decline until the Lake Ontario salmon became entirely extinct sometime between 1880 and 1900.

Whitefish and lake trout were also commercially taken from the earliest times. A considerable number of sturgeon and lake herring were caught but were considered to be worthless. Later, the lake herring became important in the commercial fishery. The sturgeon had virtually disappeared

by the time its commercial potential began to be appreciated. As the fishery developed, blue pike, chubs, walleye, yellow perch, and eels began to be harvested in increasing numbers. Late in the 19th Century, the carp was introduced, followed by the smelt in the 1940's. These species have since become a significant part of the total fish stocks, with the carp, white perch, and smelt entering into the commercial fishery. The alewife entered Lake Ontario as an invader and has been present in abundance in the Lake since at least 1890.

During the first three decades of the 20th Century, the fishery resource apparently reached some sort of equilibrium with man's influence and limited biological changes such as the appearance of the carp, and possibly the alewife. The commercial fishery maintained itself in a fairly flourishing condition. Although the Atlantic salmon and sturgeon had passed from the scene, the cold-water complex still retained the lake trout, whitefish, lake herring, and chubs as important contributors during this period. The higher value warm-water species such as the blue pike and yellow perch remained at a high production level, with some input from walleye and the introduced carp.

In recent years, cold-water commercial fish production has declined considerably. The commercial taking of any salmonid is not prohibited. Commercial whitefish production is restricted to the eastern end of the lake.

The blue pike has been lost commercially, if not biologically, to the Lake Ontario fishery complex. During the last few years there has been a tremendous increase in the white

perch population, and this species has dominated the warm-water commercial catch with carp and yellow perch the only other species of significance.

An expanding popular recreational fishery exists in the island areas of the eastern basin, the St. Lawrence River, and the Bay of Quinte. Smallmouth bass, yellow perch, northern pike, muskellunge, and walleye are the principal species involved in this fishery.

Lake Ontario also supports large populations of alewives and smelt, which are essentially unused commercially. Smelt support a heavily used sport fishery during their spawning runs, The inestimable value of these species is that they provide the forage base for both the salmonids and the warm-water predators that support the extremely valuable sport fishery in the Lake. Alewives and smelt, along with the salmonids, use much of the 90 percent area of the Lake that is little used by warmwater species.

The sea lamprey, whose invasion of the upper Great Lakes has been a major catastrophe for their fisheries, is considered to have entered Lake Ontario some time after the completion of the Erie Canal (about 1820) which connected the Hudson River to the Great Lakes at Oswego, New York. While a biological balance may have been achieved, lamprey predations still continue to exert at least a peripheral influence upon fish population dynamics. This influence may be one of making the fishery base more vulnerable to the effects of other influences, including environmental change. Basically, however, most analysis of the dynamics of the fishery base is largely speculative.

Vessel Captain/Pilot Training

A training program sponsored by industry, labor, and appropriate Federal agencies would be undertaken to educate winter navigators. The program would largely consist of learning by experience, or on-the-job training, supplemented by a formal training phase. Observational trips on winter transiting ships would be included. No adverse environmental impacts are anticipated from this program unless training vessel trips are an additive over and above anticipated winter shipping. Impacts in that case would be as described under "Navigation Traffic," in the "with project" section of this report.

Vessel Traffic Control

Vessel traffic control in the Great Lakes-St. Lawrence Seaway system under the proposed plan has been divided into three main sections. The first is vessel traffic control for the prevention of collisions, rammings, and groundings. The second is vessel traffic control for voyage-following assessment. The third is vessel traffic control for convoying and icebreaking scheduling assessment. The following are proposed solutions for each section mentioned above and are being considered independently of the others:

(1) No additional system is proposed to prevent collisions, rammings, and groundings for the area from Montreal to Long Point or for the open areas of the Great Lakes.

(2) There is currently no reliable method of determining if a vessel has been lost or damaged (aside from the vessel transmitting a distress signal) until the vessel is overdue

its destination or until it has failed to file a routine report to its owner. It is proposed that each vessel participating in the program be fitted (at the owner's expense) with an emergency radio beacon indicating its position at specified intervals. Since crew survival time may be reduced during the winter navigation operations, such a system seems vital.

(3) A Great Lakes automated vessel reporting system is proposed to control traffic for convoying and icebreaking. To facilitate this, regular voyage reports (at call in points) would be required from all vessels except those on a scheduled run (e.g., ferries).

Vessel Speed Control and Enforcement

Speed regulations are the responsibility of the U.S. Coast Guard and the St. Lawrence Seaway Development Corporation. Vessels, including icebreakers, can be expected to operate at speeds ranging to a maximum of 15 miles per hour.

Vessel speeds are monitored using Doppler radar or by measuring the time a vessel travels its own length. During the regular navigation season, vessel speeds are randomly checked. During the winter, on the upper Great Lakes, speed monitoring depends upon the level of vessel traffic.

Studies are being conducted at the U.S. Army Cold Regions Research and Engineering Laboratory to look at the relationships between ice, winter navigation, and shoreline damage. The Environmental Assessment, FY 79 Winter Navigation Demonstration on the St. Lawrence River also addresses some of these relationships.

Sport fishing in Lake Ontario and the many tributary rivers provides high quality recreation near large population centers. This fishery is made up of both warm-water and cold-water fishes.

Important warm-water species include white perch, white bass, yellow perch, walleye, northern pike, rock bass, muskellunge, largemouth bass, smallmouth bass, white crappie, black crappie, bluegill and bullheads.

Cold-water fishes of importance are lake whitefish, cisco, smelt, lake trout, rainbow trout, brook trout, brown trout, coho, and chinook salmon.

There is little variation in preferred species when the various subbasins of the Lake Ontario watershed are compared. Walleye, smallmouth and largemouth bass, and several species of pike and trout are the most popular fish throughout the basin. Most of the streams and lakes are rich in nutrients and produce good populations of fish.

The blue pike, which was once a significant part of the commercial fishery catch of Lake Ontario, is now on the Federal Government's list of Threatened and Endangered Species of Plants and Animals. The species, if it exists at all, is very uncommon. The reasons for decline are believed to have been a deterioration in the physical, chemical, and biological environment of Lake Huron within the past 20 years or so.

No blue pike spawning activity or locations have ever been documented in Lake Ontario. It has been thought that most

of the blue pike that occurred in Lake Ontario came from Lake Erie since abundance in Lake Ontario coincided with abundance in Lake Erie. However, this may reflect ideal conditions occurring simultaneously in both lakes since the commercial catch of blue pike from Lake Ontario reached the hundreds of thousands of pounds annually. It is difficult to perceive that all of this production represented spillover from Lake Erie, particularly since a lot of blue pike were taken in eastern Lake Ontario, several hundred miles from the mouth of the Niagara River. Furthermore, records from the late 1930's show that blue pike were taken in spawning condition from Lake Ontario in the Niagara County area.

The future fisheries of Lake Ontario will continue to change from that which now exists, whether the navigation season extension project is implemented or not. The degree and nature of change would depend upon fishery management efforts undertaken. The State of New York expects to continue to develop and maintain in Lake Ontario one of the finest salmonid fisheries in the country, in combination with an excellent warmwater fishery in the Lake and the St. Lawrence River. This, combined with an excellent fishery in Lake Erie and the Niagara River, makes the State's Great Lake sport fishery extremely important to the statewide economy and one of the best freshwater fisheries in the world.
To even begin to visualize future conditions, certain basic assumptions must be made. Accordingly, the Fish and Wildlife Service's assessment of projected Lake Ontario fisheries without-the-project is based on certain key premises.

It is assumed that, overall, the quality of Lake Ontario waters will not become degraded or deteriorate beyond existing conditions. The Federal Government's mandate to clean up the nation's waters is expected to provide the impetus and necessary safeguards to protect water quality, while New York State's pure waters and environmental protection programs will ensure protection of the Lake Ontario resource base. Shoreline development by individuals, industrial interests and commercial enterprises may tend to negate to some extent the promise of a high quality aquatic environment. It is expected, however, that future developments will be implemented in a more environmentally sound manner than most prior developments. It is reasoned that dredge and fill activities along shorelines and tributary streams, in addition to point source effluent discharges, will be subject to more stringent requirements and regulations than are now demanded. For fish and wildlife planning purposes, it is foreseen that Lake Ontario waters will at least maintain their present level of quality.

The rapidly developing sport fishery for salmon and trout in portions of Lake Ontario is expected to continue its present trend. The Sea Lamprey Control Program, which has been cooperatively carried out on the Great Lakes for about three decades by the United States and Canadian Governments, is now paying dividends. Sea lamprey populations have been reduced and there has been a dramatic decrease in lamprey predation on lake trout, salmon and steelhead. Lake trout populations are expected to rebound due to the control efforts and important ongoing lake trout restocking programs. The Fish and Wildlife Service envisions the continuation of lamprey control activities and the lake trout plantings in Lake Ontario.

Coho and chinook salmon plantings in Lake Ontario are primarily due to the efforts of the State of New York. It has rejuvenated sport fishing in the lake and on certain tributary streams. The future for coho and chinook salmon in Lake Ontario appears to be promising. Again, an assumption has been made that these salmon fisheries will be perpetuated and allowed to expand through stocking and management by the State of New York in order to satisfy sport fishing demands of present and future anglers.

With the continuation of the Sea Lamprey Control Program, lake trout planting, and the regular stocking of salmon, Lake Ontario has the potential of providing outstanding sport fishing for many hundreds of thousands of anglers annually. The prospects for a large resurgence of commercial fishing is conjectural. In brief, the future Lake Ontario sport fishery, without the winter navigation season extension, can be expected to be improved and more heavily utilized by fishermen than the existing fishery. The traditional and newly developed ice fishing areas would maintain their popularity and continue to provide fishing opportunities.

Sport fishing on Lake Ontario is developing into an extremely popular recreational pastime and significantly contributes to local and regional economies. Major investments are made in equipment, such as boats and motors, necessary for open water bass fishery. Many anglers invest money in party boat fishing trips complete with guide service. The offshore fisherman invests a relatively small amount in rods, reels, and bait. There are no reliable figures available on the actual value of Lake Ontario's sport fishery.

2. With the Project

The following is a listing of various segments of the Navigation Season Extension Program and the anticipated effects on fish life and related biological systems of Lake Ontario.

Icebreaking Requirements

Icebreaking will take place on the open lake and in Rochester and Oswego Harbors. There is no proposed winter navigation proposed for Great Sodus Bay. The effects are thought to be concentrated in the shallow, near-shore areas, shallow bays and harbors. The powerful thrust of propeller wash could cause sediments to become resuspended and move about, displacing and smothering benthos. Fish would be exposed to turbulent currents, placing added stress on them. Loss of fish resources could result from both effects.

Icebreaker Mooring Improvements

In regard to Lake Huron proper, Type C icebreaker facilities will be required at Rochester and Oswego Harbors. These include the use of shoreland for storage facilities, a pier and an access channel between the navigation channel and the proposed pier. The project-plan does not give enough detail to determine what resources may be affected. It is assumed that these mooring facilities generally will be located at or near existing Coast Guard facilities, thus minimizing need for additional lands. If the new facility is proposed to be located on fill in a wetland, fish and wildlife losses would occur. Dredging would displace bottom habitat and the associated benthos. Spoil placement was

not discussed. We assume that if the spoil is polluted, it will be placed in confined spoil areas. However, the placement of unpolluted spoil in water areas is just as critical in the displacement of valuable fish habitat.

Ice Control Structures

At the present time, ice control structures for Lake Ontario will be installed only at the entrance to Oswego Harbor. A more detailed discussion will appear in the appropriate harbor section. Ice booms do not appear to have significant effects on fishery resources. The anchors will be buried in the bottom and left in place. This could cause minor and temporary losses of habitat and fish food supply. Since the booms would be used only during winter and removed in spring, the anchor area will rehabilitate in a relatively short time.

Air Bubbler Systems

There are no proposals to install air bubbler systems on Lake Ontario or harbors at the present time.

Dredging

Fishery resources of Lake Ontario would be adversely affected by the proposed dredging of access channels for proposed icebreaker mooring facilities at Rochester and Oswego Harbors. The spoil from dredging also would have adverse effect, depending on where it is placed.

Island Transportation Assistance

There is no need for island transportation assistance on Lake Ontario.

Vessel Speed Control and Enforcement

Excessive vessel speed is not expected to have serious effect on the fishery resources of Lake Ontario. The open lake is deep and bottom and shoreline disturbance from vessels is expected to be minimal, if occurring at all. Downstream in the St. Lawrence River, fishery resource and habitat losses will occur.

Vessel Operating and Design Criteria

Presently there are ships operating in the system, including Lake Ontario, which do not have the modifications outlined in the existing operating and design criteria. Fish resources as well as humans are imperiled because ships are not modified to include the outlined safety features. An accident involving these ships probably would be more severe, including the probability of more severe oil or hazardous substance spills. Strict requirement of incorporating these modifications for winter navigation would reduce the probability of accident.

Oil/Hazardous Substance Contingency Plans

The lack of compliance with the operating and design criteria causes the probability for a spill to increase. Up to now, the existing contingency plan is untried in winter. Several of the described contingency plan segments do not

adequately protect the fish resources from a spill. The National Strike Team response time of four hours is inadequate for a spill involving wind-driven waters of Lake Ontario or near flowing waters of the St. Lawrence River. A spill could travel a long distance downstream in that time. Containment booms have not performed satisfactorily even under more ideal conditions than those found in winter. Response time for the regional teams also is too long. By the time cleanup equipment is on the site, spills can extend downstream or downwind a long way. Fish eggs, if they happen to be in the area, would be destroyed. Spawning habitat could be made unusable, if the spill reaches it, even if fish eggs are not present. A spill also could destroy the benthos living in and on the bottom. The heavier petroleum products sink to the bottom and could cover the benthos, an important food source for the fishes.

Environmental Plan of Action

The following discussion assumes that navigation season extension will not be implemented on the St. Lawrence River. Should navigation season extension be implemented on the St. Lawrence River, the additional impacts on the resources of Lake Ontario would have to be evaluated. One impact which has already been identified would be water level changes resulting from project modifications and ice cover disturbance on the St. Lawrence River. However, major water level impacts on Lake Ontario resources are predicted only if winter navigation is implemented on the St. Lawrence River. This impact is developed more fully in the discussion of water level impacts on the St. Lawrence River.

The proposed activities are not known at this time to have any effect on endangered fish species or their habitat. These comments were developed without a field survey and do not satisfy the requirements of the formal consultation process referred to in Section 7 of the Endangered Species Act of 1973. If, through the project investigation, endangered species or their habitat are found in the project area, the formal consultation process should be initiated by writing to the Regional Director, U.S. Fish and Wildlife Service, Newton Corner, Massachusetts 02158.

D. Wildlife

1. Without the Project

Wildlife resources in the Lake Ontario Basin have long been both abundant and varied. In the past century, however, there have been many changes. From the 1820's to the 1880's, land clearing and farm building activities were at their height. Vast areas of timber were cleared for farm land. More recently, with the advent of modern forestry, reforestation has become important. The trend toward denuding of the land has gradually reversed. Reverting farm lands to reforested areas now provide essential habitat for wildlife, thereby enabling many forest-dwelling species to survive. For example, the much greater volume of browse which has become available to white-tailed deer has allowed deer herds to increase to far greater numbers than the primeval forests were ever able to carry.

Cover is good over most of the basin and farming is restricted to localized areas of suitable soils. Second-growth forest

covers approximately 50 percent of the region. Tree species in the eastern half of the basin are those of the northern forests: balsam, fir, white pine, hemlock, birch, spruce, maple and aspen. Trees common to the deciduous forest are found at the lower elevations in the western half of the basin. The higher elevations of the western half also have the northern tree species.

Several habitat types have been identified along the Lake Ontario shoreline. The natural habitats include mature forests, swamp forests, old fields, new fields, wetlands, and dune complexes. Urban, industrial, and agricultural lands constitute greatly modified habitats.

Tne distribution and variety of game in the Lake Ontario Basin offers the New York hunter many hunting opportunities. Waterfowl, ruffed grouse, gray and fox squirrels, ring-necked pheasants, cottontail rabbits, snowshoe hare, white-tailed deer, and black bear are the principal species hunted in the basin. Well over half of the hunters take upland game in the basin. Highest rates of success are provided by squirrels, rabbits, and waterfowl--in that order.

Waterfowl of the Lake Ontario Basin are within the Atlantic Flyway, one of four such Flyways in the United States. The principal nesting and resting areas in the Lake Ontario Basin are Montezuma and Iroquois National Wildlife Refuges, the Finger Lakes complex, the State Oak Orchard and Tonawanda Game Management Areas, and the marshes and ponds along the Lake Ontario shoreline.

Species migrating through the area include the Canada goose, brant, mallard, black duck, greenwinged teal, bluewinged teal, wood duck, redhead, canvasback, and bufflehead. Generally, populations of ducks and geese in this area are stable or increasing, although the black duck is rapidly disappearing as a breeder, being genetically overwhelmed by the mallard.

Aquatic wildlife, including waterfowl, shore and marsh birds, mink, beaver, muskrats, raccoon, and otter, depend upon the rivers, streams, lakes, and natural wetlands for their existence. Suitable habitat occurs in scattered marshes along the Lake Ontario shoreline and along tributary streams. Of special significance is the extensive series of wetlands and barrier beach/dune systems located along the eastern shore of Lake Ontario. Some of these lands are now in public ownership.

It is expected that wildlife resources of the Lake Ontario drainage will be subjected to increased adverse impacts in the future. The single, most important factor affecting wildlife resources and their habitats is human population growth and the resultant increase in land-use intensity.

Population increases will cause losses of wildlife habitat through the various activities that demand land/road construction, agriculture, housing developments, industrial parks, recreation areas, and other related needs. Degradation of the quality of habitat will also occur as a result of human habitation and activities, but these effects may be less conspicuous. Wildlife resources will be faced with larger demands being exerted by the utilizing public. As a consequence, wildlife managers will inevitably be faced with the task of more intensive management of the resources if human demands are to be met.

The State of New York, the Federal Government, and local governmental jurisdictions will need to carry out vigorous, imaginative programs and plans if the future population is to be provided with wildlife recreation opportunities. The programs will need to consist of land acquisition, the protection of important and unique habitats, and the provision of public access. New or amended legislation designed expressly to benefit and enhance wildlife resources would be axiomatic.

Wildlife resources in the Ontario drainage will continue to provide outdoor opportunities for hunting, birdwatching, photography and the other related activities; however, the quality of the experience is expected to decline due to more crowding and competition from participants.

In the future, nonconsumptive wildlife use (non-hunters) is expected to exceed consumptive use. The nonconsumptive users (birdwatchers, photographers, hikers, etc.) will probably increase faster than projected hunter use in some areas.

Local ordinances, State laws, and other safety limitations are forcing a decrease in the use of firearms. Lower-quality hunting experience due to degraded habitat and fewer game animals is reducing the desire to hunt, while the desire to use wildlife habitat for nonhunting purposes is increasing greatly. State game lands near cities are receiving more off-season than hunting use. Increases in these areas and other wildlife lands will benefit the nonconsumptive user more as time goes on.

In 1970, over 382,000 hunters were active in the eastern basin of Lake Erie and the Lake Ontario basin (excluding the St. Lawrence River basin). This figure includes more than 52,800 unlicensed hunters and 4,400 nonresident hunters. Had these hunters been active in 1960, they would have utilized approximately 5.9 million acres of farmland and 3.6 million acres of forest land for hunting. By 1970, increasing human densities in these areas with concurrent urban development have reduced these acreages considerably. By 1980, hunters in these areas will require at least 86 thousand acres of wildlife habitat to fulfill their recreation needs (no description of wildlife habitat as farmland or forest was available).

2. With the Project

Various operational measures considered necessary for extended season operation on Lake Ontario could produce changes in the environment which would ultimately affect wildlife of the lake year-around.

The following is a listing of the various segments of the project with anticipated effects on the wildlife of Lake Ontario.

Icebreaking Requirements

Icebreaking will take place on the main body of Lake Ontario, with vessel tracks to the harbors of Rochester and Oswego. The effects are most felt in the shallow near-shore water where the track is in dredged channels and other shallow waters. The powerful propeller wash causes currents which resuspend sediments and cause some bottom scour. This would

displace and smother some benthos and other material used as food by the wintering water birds, including waterfowl. In addition, icebreaking may create open water areas which would attract the wintering birds. If they are in a rather stressed state and food supplies are limited, they might be subject to high mortality.

Ice Mooring Improvements

The improvements at Rochester and Oswego Harbors involve the use of shorelands for storage facilities, a mooring pier, and an access channel between the pier and the navigation channel. The project plan does not give enough detail to determine what resources may be affected. We assume that these facilities generally will be located at or near existing Coast Guard facilities. If the new facilities are proposed to be located on fill in a wetland, wildlife losses would occur. Dredging may displace bottom habitat and associated benthos used as food by wildlife. Spoil placement was not described in the project plan. Many of the harbor bottoms are highly polluted. We assume that if dredging of these polluted bottoms occurs, the spoil would be confined in areas where material cannot return to the water. The placement of unpolluted spoil in water and wetland areas is just as critical in displacement of valuable wildlife habitats.

Ice Control Structures

An ice boom is proposed at the Oswego Harbor entrance. A more detailed discussion of these structures will appear in the appropriate harbor segments of this report. Ice

booms appear to not have significant effects on the wildlife resources. A small amount of open water may remain behind the boom. This may be attractive to waterfowl but this will be located over relatively deep water and, therefore, be used only for resting.

Air Bubbler Systems

Air bubbler systems are not currently being considered for implementation on Lake Ontario or any of the harbors.

Dredging

The only dredging proposed in Lake Ontario is that proposed for icebreaker mooring facilities and discussed under Icebreaker Mooring Facilities (above). Both the dredging of the channels and the associated spoil placement would affect the wildlife resources.

Vessel Speed Control and Enforcement

These regulations, or lack of them, can have a profound effect on the wildlife habitat within the areas where pressure waves are generated. The shoreline, wetlands and the shallow water areas have been observed to be particularly vulnerable to the phenomenon. Vessel speed is one of the factors governing the generation of pressure waves. The areas where these waves can be generated include the entrances to Rochester and Oswego Harbors. The lack of adequate vessel speed controls and enforcement has caused severe damages in other areas of the Great Lakes. Wildlife habitat has been eliminated. Without adequate vessel speed control

and enforcement at the above-mentioned critical areas, wildlife habitat could be severely affected. Even with controls, damages to the habitat may be severe.

Vessel Operating and Design Criteria

There are ships presently operating in the Great Lakes which do not have the modification outlined in the existing operating and design criteria. Wildlife resources, especially waterfowl, are particularly vulnerable and imperiled because these ships are not modified and, therefore, subject to a higher probability of accident. An accident involving those ships probably would be more severe and incidence of associated oil or hazardous substance spills would be higher. The requirement of incorporating these modifications for winter navigation would reduce the probability of accident and resultant spills.

Oil/Hazardous Substance Contingency Plans

Up to now, the existing contingency plan is untried in winter. Several of the described plan segments do not adequately protect the wildlife resources, particularly the vulnerable waterfowl. The response time needed for the National Strike Team and the regional teams to respond is too long. By the time the equipment is on site, the spill could extend a long distance, especially when carried by strong water current or driven by winds. Damage to the wildlife resources would consist of oiled animals and birds, and habitat damage and destruction. The heavier petroleum products could sink to the bottom coating it and smothering the food organisms there. If not cleaned up properly, the vegetation coming out in spring also could be affected by a winter spill. In addition to the long response time, some of the equipment

is admitted to be less than satisfactory. New, more efficient equipment should be sought and conveniently stockpiled throughout the basin.

Environmental Plan of Action

The following discussion assumes that navigation season extension will not be implemented on the St. Lawrence River. Should navigation season extension be implemented on the St. Lawrence River, the additional impacts on the resources of Lake Ontario would have to be evaluated. One possible impact which has already been identified would be water level changes resulting from project modifications and ice cover disturbance on the St. Lawrence River. However, major water level impacts on Lake Ontario resources are predicted only if winter navigation is implemented on the St. Lawrence River. This impact is more fully developed in the discussion of water level impacts on the St. Lawrence River.

Endangered Species

The Endangered Species Act of 1973, Public Law 93-205, as amended, lists as endangered the following species which are found in the Lake Ontario region:

1. Bald eagle (*Haliaeetus leucocephalus*)
2. Peregrine falcon (*Falco peregrinus*)
3. Blue pike (*Stizostedion vitreum glaucum*/

E. LAKE ONTARIO HARBORS

1. Rochester

a. Description of Areas

The City of Rochester is the third largest city in New York State. It is located on the south shore of Lake Ontario at the mouth of the Genesee River in Monroe County. The city is a world leader in the manufacture of precision goods. The City of Rochester had a population of 232,000 in 1970 while the Rochester Standard Metropolitan Statistical Area had a population of 0.9 million inhabitants in 1970.

The existing Federal harbor project provides for parallel piers at the river mouth and an improved channel extending from deep water int the lake to about 3 miles upstream in the river. Depths are maintained at 24 feet in the lake approach, 23 feet in the entrance channel between the piers and a turning basin just within the harbor, and 21 feet in the balance of the improved channel, including a second turning basin at the upper end. Waterborne commerce consists principally of bulk cement and salt. Annual traffic during the 10-year period 1964 through 1973 averaged 555,000 tons, with 1973 traffic being 433,950 tons.

Sediments of Rochester Harbor are considered to be highly polluted, stemming from industrial effluents and sewage and storm discharges.

b. Description of Project

Mooring facilities are currently being proposed by the Coast Guard for a Type C icebreaker at Rochester Harbor. It is assumed at this time that ancillary dredging, extending from the main harbor channel to the mooring facilities, will be required to berth and

operate the icebreaker. The icebreaker also will require additional storage facilities on land.

c. Fish

(1) Without the Project

Important fish species in Lake Ontario in the vicinity of Rochester Harbor include smallmouth bass, yellow perch, bullhead, northern pike, and a variety of panfish. The salmonid fishery is also very significant in Lake Ontario and it is expected that such species as coho and chinook salmon and brown, rainbow, and lake trout can also be found from time to time in the Rochester Harbor area.

(2) With the Project

Since the specific location and design of mooring facilities for a Type C icebreaker in Rochester Harbor are not presently available, our discussion of the effects of the proposal on fishery resources will be very general. When more detailed plans become available in the future, we will provide more detailed comments.

The shallow areas around Rochester Harbor are important biologically. Some fish species utilize the area for spawning purposes. As the polluted sediments in the harbor are gradually eliminated through water quality enforcement and maintenance dredging, the harbor bottom is expected to become

more productive for benthos and other fish food organisms. Shallow wetlands around the harbor periphery also provide habitat for migrating and nesting waterfowl and shorebirds.

Icebreaking could cause polluted sediments in Rochester Harbor to become resuspended and move about, covering benthic habitat. It could disturb fish, increasing under-ice movement, changing winter habitat, and producing additional stress at a critical time of year. Feeding and spawning areas could also be altered. Sport and commercial fishing activities could be disrupted.

If the mooring facilities are located in or near any of the few wetlands along the shore, fish spawning and nursery areas would be adversely affected. Dredging during construction and maintenance of the facilities would displace valuable shallow bottom habitat and associated benthos. Pollutants directly toxic to aquatic organisms could be resuspended and redissolved. Public and private sport fishing could be lost.

Discharges and spills of oil and toxic substances could be lethal to aquatic organisms depending on the particular substance, amount, and exposure time. Also, during cold weather, oil could congeal, sink to the bottom and destroy or degrade habitat for fish and fish food organisms.

d. Wildlife

(1) Without the Project

Habitat types along Rochester Harbor are urban, residential, and industrial areas, open fields, croplands forests, and wetlands. Whitetail deer. raccoon, eastern cottontail, gray and red squirrel, red and gray fox, mink, and muskrat are important game animals and furbearers of the general area.

Waterbirds are an important part of the fauna of Rochester Harbor. Mallards, blue-winged teal, and wood ducks probably nest in the vicinity.

Ruffed grouse and woodcock are upland game birds found in the general area. These species are not important in the immediate harbor vicinity however.

Hunting, trapping, birdwatching, and nature study are also popular activities in the general area, but estimates of the amount of participation are not available.

(2) With the Project

Icebreaking could destroy wetland vegetation through movement of ice and sediments. Benthic food organisms for waterfowl also could be destroyed by sediment movement due to icebreaking. Additional open water could attract additional waterbirds, possibly to areas with insufficient food. Wintering waterbirds would be forced to flee from the icebreaker, using previous energy resources. Quantitative predictions of icebreaking effects

on wildlife are difficult, but it is known that the effects are adverse.

If the facilities would be located in or near any of the valuable wetlands, direct and indirect losses and degradation of habitat would occur.

Dredging poses special problems for wildlife resources in Rochester Harbor because the sediments are polluted. Substances may be released during dredging which are directly toxic to wildlife or have indirect effects through disruption of the food chain. Polluted dredged materials must be contained, and lack of environmentally acceptable disposal sites may add to the problem. Upland disposal could destroy or degrade terrestrial wildlife habitat.

Discharge or spill of soil and hazardous substances could be lethal to wintering waterbirds and destroy or degrade benthic habitat of food organisms.

c. Discussion

Winter disturbance of sediments could affect the vulnerable eggs and fry of fall and winter fish spawners. Ship traffic could also affect ice fishing. Spills or discharges of oil and toxic substances would adversely impact the eggs or young or some species of fish and benthos. Production of benthic organisms, used as fish and wildlife food, could be reduced from spills, also.

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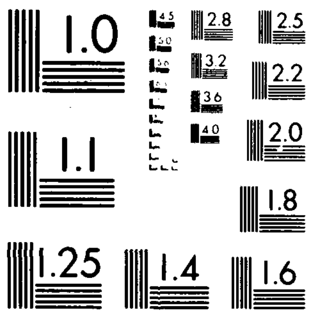

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The location of the mooring facility in Rochester Harbor is not definite at present. It is not known if sufficient space exists at the station for the additional mooring facility. Alternative pier sites should be developed with an environmental assessment for each.

Effects of dredging for new icebreaker mooring facilities may include disruption of fish migration and spawning, reduction in production of benthic organisms, mortality to fish eggs and larvae, and destruction of aquatic or terrestrial habitat from dredged material disposal. Some sediments in parts of the harbor are polluted and can only be disposed of in impermeable containment facilities. A suitable site would have to be obtained prior to dredging.

At the present time there is insufficient specific information regarding the design and location of additional mooring or icebreaker berthing facilities in Rochester Harbor. Due to this lack of specific details, it is not possible at this time to identify or formulate particular studies that would aid in the assessment of potential project impacts.

Consequently, the Fish and Wildlife Service reserves the right to provide additional comments at such future time as the project sponsor elects to provide specific, detailed plans for new works or modifications of existing facilities, that would be necessary to implement extended season navigation in Rochester Harbor.

2. Oswego

a. Description of Area

Oswego Harbor is located at the mouth of the Oswego River on the south shore of Lake Ontario, 56 miles northeast of Rochester, New York. The City of Oswego had a population of about 19,900 inhabitants in 1970.

The existing Federal project provides for a system of breakwaters with a large protected outer harbor area off the mouth of Oswego River with a smaller basin to the west. The more recent modification to the project, authorized by Congress in 1962 and providing for dredging a lake approach channel to 27 feet, deepening a portion of the main outer harbor area to 25 feet, and deepening the lower portion of the river channel to 24 feet, was completed in 1965. Depths in the balance of the outer harbor, the west basin, and in the upper portion of the river channel, provided in accordance with older authorizations, are 21 feet.

Up until the winter of 1977-78 Oswego Harbor remained relatively ice-free due to the influence of a heated effluent discharge from a complex of power stations owned and operated by Niagara Mohawk Power Company. Prior to the onset of the 1977-78 winter the power plant discharge was moved outside of the harbor breakwaters. This has resulted in increased ice formation in the harbor.

Waterborne commerce at the harbor is varied, with the principal commodities being petroleum products, bulk

cement, and chemicals. Average annual traffic during the 10-year period 1964 through 1973 amounted to 477,000 tons and 1973 traffic was 931,000 tons.

The climate of Oswego, as with other ports on the Lake Ontario shoreline, is greatly influenced by Lake Ontario which acts as a vast reservoir for the storage and subsequent exchange of heat with the atmosphere. Oswego experiences warmer winters and cooler summers than inland areas.

The Oswego River has pollution problems of varying degree and nature. Specific knowledge on pollution aspects of Oswego Harbor are lacking at this time. It is assumed by the Fish and Wildlife Service, however, that harbor sediments are polluted and dredged spoil would need to be contained.

b. Description of the Project

Proposed improvements associated with the Navigation Season Extension project at Oswego Harbor include the installation of an ice boom at the harbor entrance and mooring facilities for a Type C icebreaker.

The ice boom, to be 1600 feet long, would be installed on a northwest to southeast alignment at the outer harbor entrance. (See Figure XII-B-2-1)

The precise location of proposed Coast Guard mooring facility for the Type C icebreaker presently is not known, but presumably will require some dredging at Oswego Harbor. Additionally, the icebreaker will require auxiliary dockside storage facilities.

c. Fish

(1) Without the Project

Sport fishing is popular in Lake Ontario and supports a multi-million dollar industry. Important game fish composing the Lake Ontario fishery resource include the smallmouth bass, yellow perch, bullhead, northern pike, and a variety of panfish. The salmonid fishery in Lake Ontario is very significant including such species as coho and chinook salmon and brown, rainbow, and lake trout. It is expected that any or all of these species at times may frequent or inhabit Oswego Harbor, some as permanent residents, others on a seasonal or migratory basis. There is, in fact, a significant salmonid fishery developing within the harbor that is extensively utilized by local fishermen.

(2) With the Project

The effects of icebreaking in Oswego Harbor by the Coast Guard icebreaker will have the most pronounced effects in the shallow areas of the harbor. The powerful thrust of propeller wash could cause polluted sediments to become resuspended and move about, displacing and smothering any benthos present. Fish could be exposed to turbulent currents, placing added stress on them. Loss of fish resources could result from both effects.

d. Wildlife

(1) Without the Project

The lands immediately surrounding Oswego Harbor are typically urban or industrial and provide relatively little high quality wildlife habitat.

(2) With the Project

The existing wildlife species composition of the Oswego Harbor area should not be significantly altered by the proposed project. However, adverse effects may be felt by the existing fauna. Should the proposed ice boom and icebreaking activities result in additional open water, more waterfowl may be lured to stay, with the possibility of mortality due to malnutrition when feeding areas become ice covered. An oil spill in winter also could produce high mortality because of birds concentrated in open water areas.

e. Discussion

It is expected that Oswego Harbor and vicinity provides habitat for a number of fish species that are important to the sport fishery. Wildlife resources are believed to be limited due to the urban and industrial character of the harbor area.

Any existing shallow waters are important habitat niches for fish as well as shore and marsh birds and waterfowl.

The location of the icebreaker mooring facility at Oswego Harbor is not definite at present. It is not known if sufficient space exists for the additional mooring facilities.

Effects of dredging for new icebreaker mooring facilities may include disruption of fish migration and spawning, reduction in production of benthic organisms, mortality to fish eggs and larvae, and destruction of aquatic or terrestrial habitat from dredged material disposal. Sediments in the harbor are assumed to be polluted and may require impermeable containment facilities. A suitable site would have to be obtained prior to dredging.

At the present time, there is insufficient specific information regarding the design and location of additional mooring or icebreaker berthing facilities in Oswego Harbor. Due to this lack of specific project details, it is not possible at this time to identify or formulate particular studies that would aid in the assessment of potential project impacts.

Consequently, the Fish and Wildlife Service reserves the right to provide additional comment at such future time as the project sponsor elects to provide specific, detailed plans for new works, or modifications of existing facilities, that would be necessary to implement extended season navigation in Oswego Harbor.

F. Discussion

Vessel passage through shallow areas, such as those found at Rochester and Oswego Harbors, could cause movement of bottom materials where depths are shallow. Since both lake trout and lake whitefish are fall spawners, winter disturbance of sediments would affect these species and their vulnerable egg and early larvae stages. Ship traffic could also affect ice fishing which may occur in the vicinity. Spills or discharges of oil and toxic substances would adversely impact the eggs or larvae of lake whitefish. Production of benthic organisms could be reduced from spills also.

Effects of dredging for new icebreaker mooring facilities may include disruption of fish migration and spawning, reduction in production of benthic organisms, mortality to fish eggs and larvae, and destruction of aquatic or terrestrial habitat from dredged material disposal. Sediments in the Lake Ontario Harbors at Rochester and Oswego are polluted and can only be disposed of in impermeable containment facilities.

Icebreaking in nearshore areas has the same effects as previously described for vessel passage with the addition of creating unsafe ice conditions for sport and commercial ice fishing. Access to traditional fishing sites might be hampered by maintaining vessel tracks throughout the winter.

It may be that the Great Lakes' relatively few sheltered open water areas with a food supply are important to wintering waterfowl in measure beyond their limited size. Waterfowl from a widespread breeding area are concentrated in and near them in winter. Waterfowl attracted to such open water feed on small fish and benthos. If this food supply is depleted, they may not leave, or if they do, they may be unable to find another

protected area with food available at suitable water depths. Also, the nutritional state of migrating waterfowl in fall and early winter appears to be very important. Reproductive success may depend greatly on birds having adequate food in the pre-reproductive period of spring migration. If the fish and benthos are reduced by winter shipping, waterfowl reproductive success might be reduced in spring.

The impact of reduced benthos and fish life is not limited to waterfowl. Gulls, terns, herons, grebes, ravens, cormorants, crows and terrestrial carnivores scavenge dead fish and actively pursue live ones. The gulls, terns, mergansers, grebes and cormorants absolutely require fish. The food supply is essential for the presence of these birds and the habitat would be degraded by direct loss of fish or the benthos that many of the fish feed on.

The potential for elimination of the benthos and fish from large parts of the harbors--or well beyond--seems greater from discharges and spills than from the mechanical impact of ship passages. The impact would depend on the timing, substance involved, weather, clean-up effectiveness and all other factors involved in the extent and severity of spills or discharges from ships. The loss of a year-class of small fish from the nursery area could seriously affect the ability of other fish as well as gulls, terns, cormorants and herons, to get enough food for themselves and their young. Spills and discharges are acknowledged to be harmful to fish and wildlife in a number of ways. Toxic substances are ingested with contaminated invertebrates by raptors preying on oiled birds or where shorebirds fed along contaminated shores or where bald eagles ate oiled fish or waterfowl. Birds in the water at the site of petroleum spills lose both insulation and buoyancy and, unless only very lightly oiled, almost always die

from hypothermia, drowning, or poisoning. Even with the best available human intervention, a very low percentage of oiled birds survive.

Winter complicates clean-up efforts and a significant spill in or near the harbors would be expected to contaminate the shoreline. The length of shoreline involved and the amount of oiling that would occur cannot be predicted because of numerous variables involved. Oil, on the water or on the shore, can get on birds' plumage. Recent research indicates that even small amounts of oil from oiled nesting birds' plumage can kill the embryos in eggs. Thus, even if the oil is not fatal to the bird that encounters it, it could eliminate that bird's breeding for the season. The local impact of this could be severe for the waterfowl, shorebirds, cormorants, gulls, terns and herons that feed and breed in the area.

As previously mentioned, waterfowl congregate in winter harbors that have both open water and some protection from wind and waves. At the same time, winter is a period of great stress for them, for food is generally more scarce than in other seasons, and the energy required for body temperature maintenance is greatly increased by exposure to winter air and low water temperatures. Further stresses may result from the crowding of the flock and the unavailability of desirable habitat. In short, the birds wintering in the harbors are under a number of stresses in an undesirable (but best available) environment. Additional expenditures of energy that have no return value will be required as birds flee oncoming ships. There will be additional forced movement to harbor and water areas where conditions are less favorable. Thus, winter shipping will also disturb the wintering water birds with each ship's passage.

Whether this anticipated degradation of the environment for birds will be directly or indirectly harmful to the populations involved is not known at present. It is a certainty, however, that the changes will be of a negative nature.

Wildlife impacts will be reduced as impacts on benthos, fish eggs, and young fish are reduced. Likewise the previous discussion of impacts from spills and discharges from ships applies; if spills and discharges are minimized, their wildlife impacts will be minimized.

Regarding disturbance by shipping, a winter water bird survey of the open areas of Lake Ontario might indicate that use levels in some open water areas are so low as to make further consideration of winter disturbance unnecessary. Or, it could indicate that parts of the lake receive far less use. The same information could be determined for the aquatic biota. Thus, it may be possible to channel winter shipping to lower use areas of the lake. It may be possible to delineate areas that are important to fish so that the ships can avoid them given the information.

The water level changes which are expected to occur on Lake Ontario as a result of implementing winter navigation on the St. Lawrence River are dealt with in the impact discussion for the St. Lawrence River portion of this report.

This information will enable us to address potential impacts caused by winter ship passage in Lake Ontario, through the application of information that may already be available and through the development of additional specific studies.

G. Recommendations

We recommend a two-phase authorization approach for the Lake Ontario portion of the system and harbors at Rochester and Oswego. This approach entails:

1. That detailed studies of fish and wildlife resources be conducted at project cost in accordance with Section 2 of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and completed prior to authorization for project construction to thoroughly evaluate anticipated project-caused impacts on such resources.

2. If after completion of studies described under recommendation 1, it is determined that project-caused adverse impacts to fish and wildlife resources could be avoided, significantly mitigated, and unavoidable losses offset, that such measures for the conservation, improvement, and development of fish and wildlife resources as may be agreed upon by the Commissioner of the New York State Department of Environmental Conservation, the Director of the Fish and Wildlife Service, and the Chief of Engineers be incorporated in any plan submitted to Congress to authorize project construction and operation.

   Should it be determined, based on system-wide preauthorization studies, that significant adverse impacts to fish and wildlife resources cannot be rectified, we would recommend that the project not be authorized for construction.

XII. THE ST. LAWRENCE RIVER

A. Description of Area

The St. Lawrence River drains an area of more than 295,000 square miles, and is the only natural outlet for the Great Lakes. The river traverses some 557 miles from its origin at the eastern end of Lake Ontario to where it empties into the Gulf of St. Lawrence. Average annual flow rate is about 239,000 cubic feet per second (cfs) and water quality is relatively high year-round. The river is normally covered with ice from Lake Ontario to Montreal for about 3 months each year.

The International Section of the River, bounded by New York State on the south and the Province of Ontario, Canada, on the north, is about 125 miles long and flows through a complex series of land and water interfaces. On the American side of the river there are about 260 islands or island groups and about 140 shoals of varying size. Mid-channel water depths vary from a project depth of 27 feet in some sections of Lake St. Lawrence to almost 300 feet in the American Narrows. There are extensive shallow water areas in bays and around shoals and islands.

The upstream, or Thousand Islands area, is characterized by large islands and broad expanses of water with many small islands and shoals interspersed. This section of the river resembles a lake with its large, open, relatively slower-flowing expanses of water. The middle section of the river, from Chippewa Bay downstream to the Iroquois Rock, is narrower with less islands and shoals. The transition from channel to upland is abrupt and flow is essentially uninterrupted by dry land in the reach from Brockville to Ogdensburg. Further downstream, from Ogdensburg to Cardinal, several large islands occur in the channel and here the middle

section of the river has been highly modified from its original natural condition and is dominated by the impounded waters of Lake St. Lawrence. This reach, containing several large islands, is the power pool for the Moses-Saunders Power Dam and development associated with the Seaway Power Project has flooded the mouths of several large tributaries. There are extensive shallow water areas around Great Neck Island Shoal and Murphy Island Shoal.

Pleistocene glacial activity shaped the surface geology of the river region. Bedrock formations of sandstone and dolomite constitute the surface geology from Chippewa Bay to Ogdensburg, except for a few areas of till deposition overlying the sedimentary bedrock. Just northeast of Ogdensburg these conditions change to a region of extensive till deposition. The St. Lawrence River Basin contains large areas of relatively flat land with high water tables and fine-textured soils. These soils are largely of sedimentary origin with permeable sandy loams dominating upper St. Lawrence County.

The climatological regime of the International Section of the St. Lawrence River is humid continental with cold winters and cool summers. Average annual temperatures at Ogdensburg, for a 10-year period (1966-76) ranged from a monthly average high of 69.6°F to a low of 11.9°F with an annual mean of 43.7°F. There is measurable precipitation about 169 days per year with a mean annual precipitation of 35.1 inches. Snowfall averages approximately 70 inches annually. The hydrologic input to the River from streams and groundwater is very small in comparison to that provided by the Great Lakes. River flow is totally controlled by a series of locks, dams, and powerhouses along the International Reach. Moses-Saunders Power Dam extends for

3,300 feet across the River from Barnhart Island, New York, to Cornwall, Ontario. The total river discharge, exclusive of that required for navigation and domestic use, normally flows through this dam. South of Barnhart Island the channel is closed by the 3,000 foot Long Sault Flood Control Dam. This dam contains 30 spillway gates and can handle the entire river discharge if necessary.

Lake St. Lawrence, the power pool, extends 25 miles upstream from Moses-Saunders Power Dam to Iroquois Dam. The 1,800 foot long Iroquois Dam can be used to control outflow from Lake Ontario in an emergency.

Ice cover on the International Section begins to form in bays along the main channel in late November. Fast ice finally stabilizes in midchannel on December 20 to 30 for severe winters, about January 10 for average winters and February 1 to 10 for mild winters. Depending on the severity of the winter, duration of ice cover ranges from 30 to 100 days in the channel to 100 to 150 days in shoreline bays. Ice cover structure and thickness varies greatly, even during midwinter conditions, throughout the International Section of the River. Midwinter channel ice varies from 2 to 24 inches in thickness, becoming deeper and more irregular at channel constrictions where ice jams naturally occur. However, even during the severest winter, upwelling currents cause open water pools to persist in the American Narrows, the Brockville Narrows, at Ogdensburg and in the Galop Island area. Traditionally, navigation on the River has ceased about December 15 and resumed about April 1.

B. Description of Project

Proposed winter navigation-related projects and impact areas on the St. Lawrence River are shown in Figure 1. Wetland areas shown on the maps represent the major ones in terms of dimension. Many other equally valuable but smaller wetland areas occur along the St. Lawrence River, and around the many islands, which would sustain damages from project features but could not be shown on the maps.

The following descriptions are provided for types of projects needed for extended navigation on the St. Lawrence River.

Icebreaking Requirements

A navigable channel through the St. Lawrence River would have to be maintained during an extended navigation season. Traditionally, the U.S. Coast Guard has provided icebreaking support in the Great Lakes System when commercial vessels operating during winter have needed assistance.

Twelve (12) Coast Guard vessels are currently engaged in icebreaking activities each year in the upper Great Lakes as part of the Winter Navigation Demonstration Program. They consist of five 180-foot buoy tenders, five 110-foot harbor tugs (not designed for icebreaking), and two icebreakers. The 110-foot class is now being replaced by a new 140-foot class.

The July 1978 Survey Study estimates a need for the following additional icebreakers: 6 type B and 22 Type C vessels (of which 2 Type B and 5 Type C vessels are already on hand).

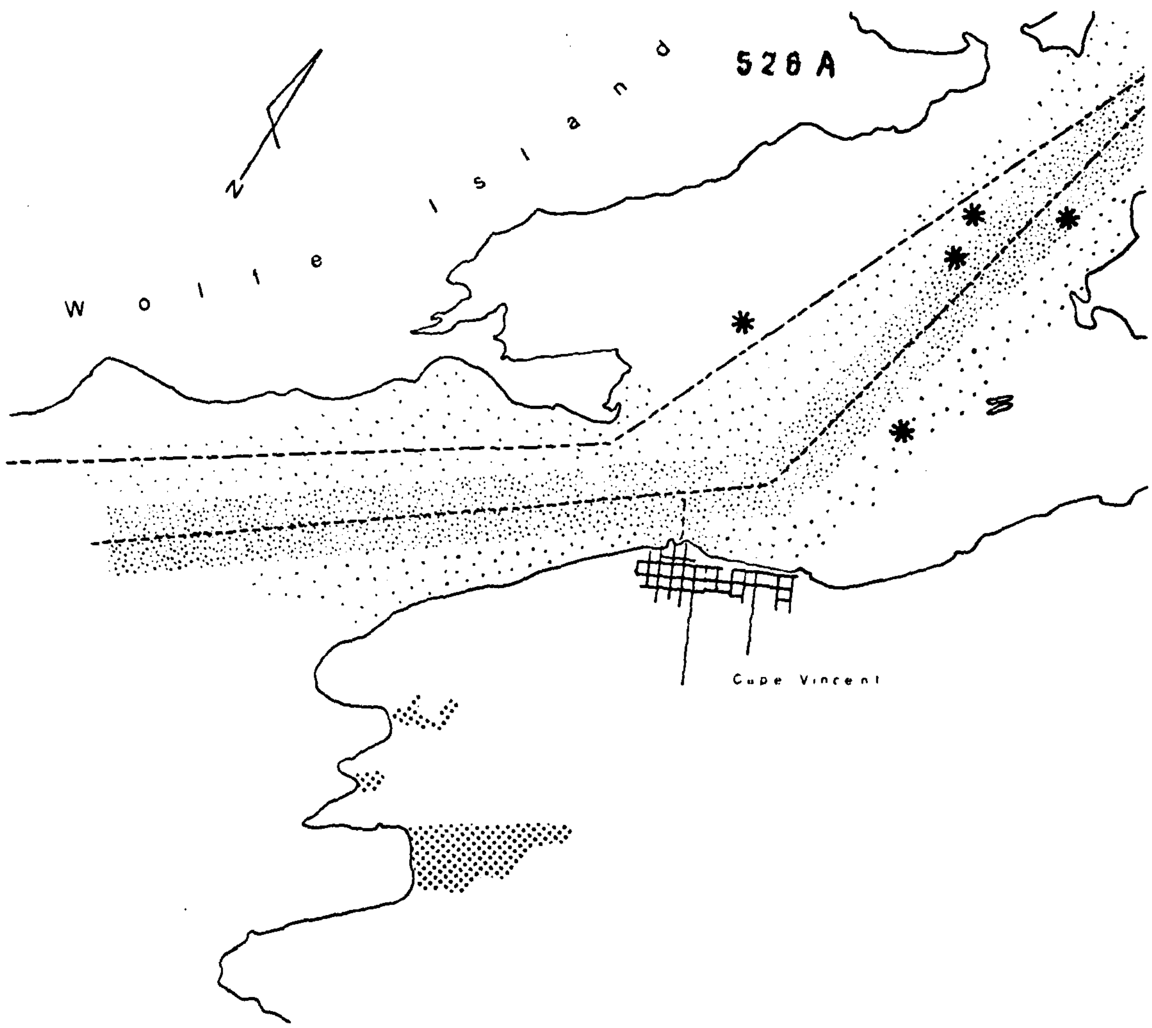


Figure 1A. Proposed winter navigation projects and impact areas on the St. Lawrence River, New York

legend

- Proposed dredging
- Possible dredging
- Ice booms
- Ice stabilization structures
- Shoal
- Open water area
- Ship wake area
- Possible ship wake area
- Wetlands
- Probable shoreline erosion
- Ship turnaround area
- Channel
- International boundry

Scale: 1 in. ≈ 2 mi.

U.S. Fish & Wildlife Service - Nov. 1978

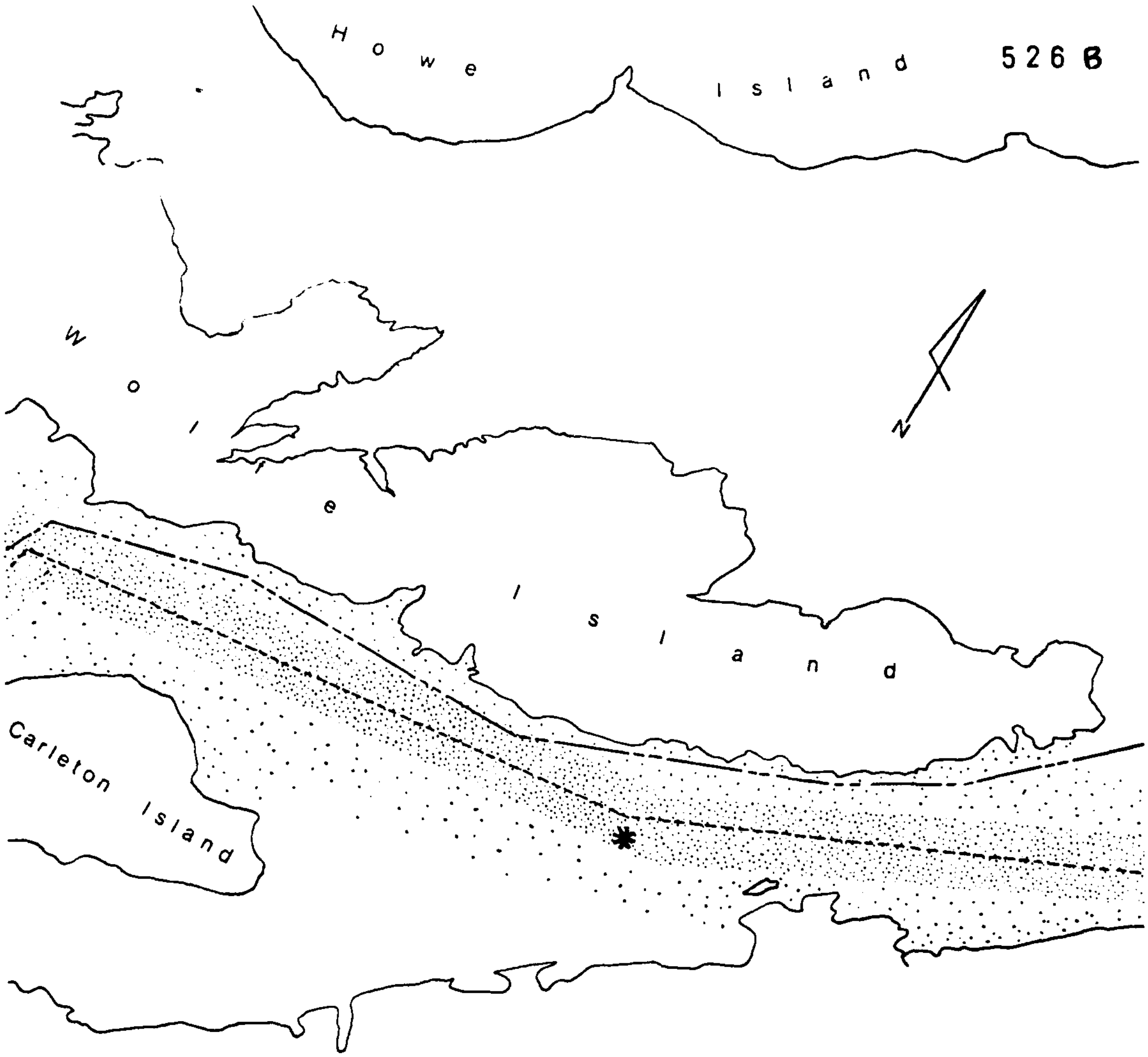
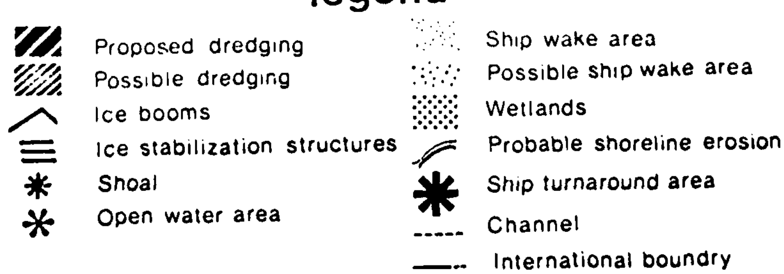


Figure 1B

legend



Scale: 1 in. ≙ 2 mi.

U.S Fish & Wildlife Service - Nov. 1978

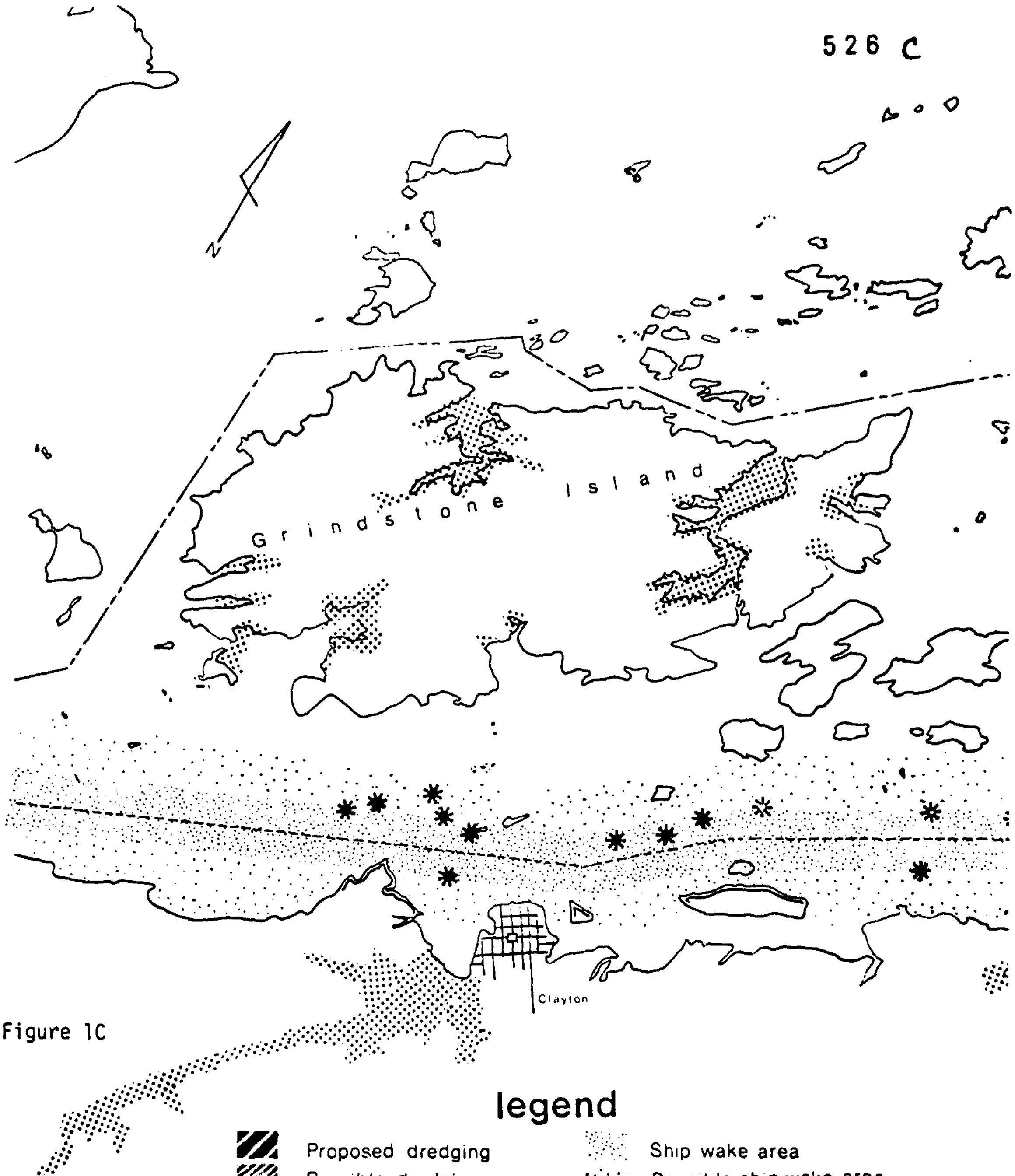


Figure 1C

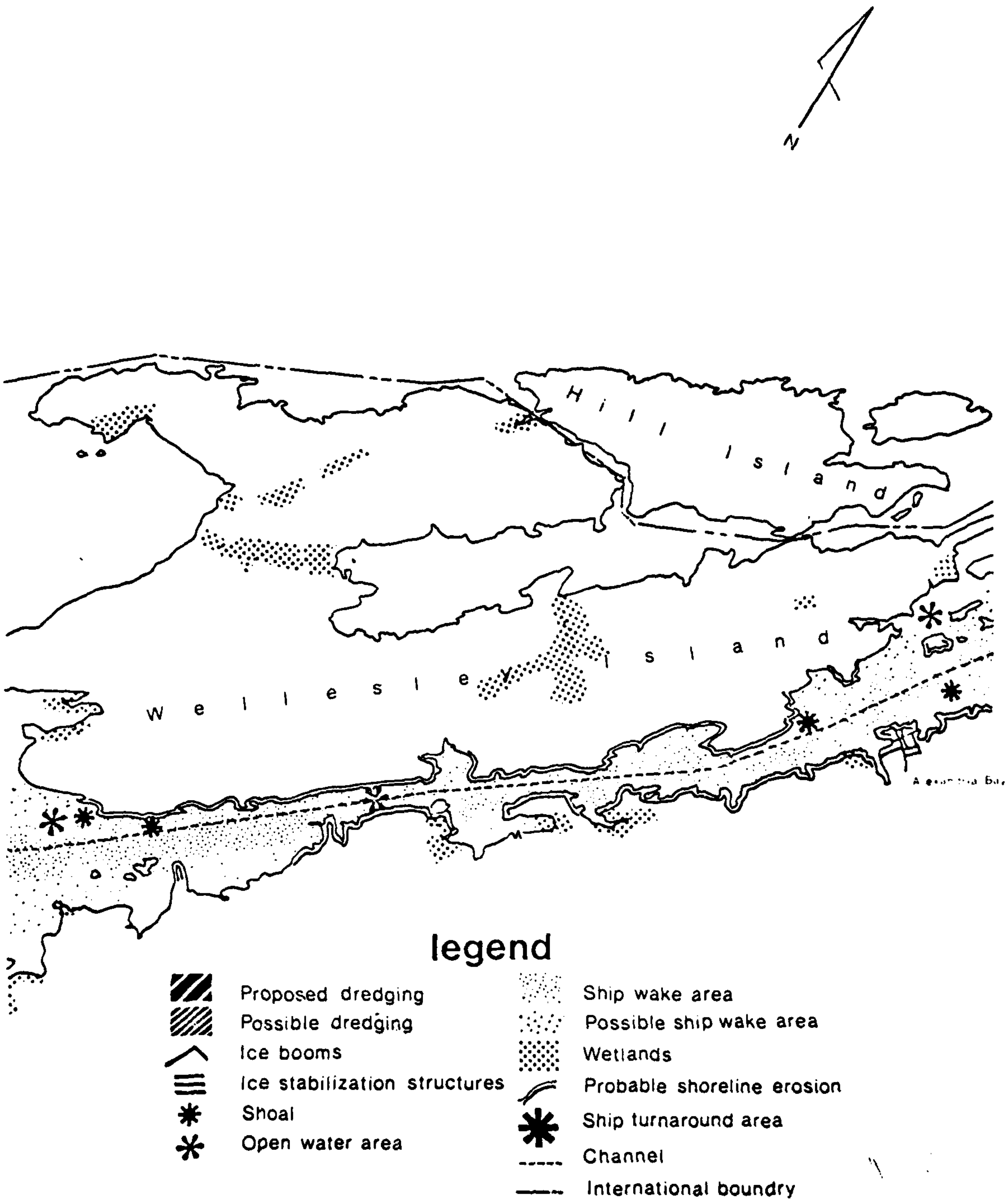
legend

Proposed dredging	Ship wake area
Possible dredging	Possible ship wake area
Ice booms	Wetlands
Ice stabilization structures	Probable shoreline erosion
Shoal	Ship turnaround area
Open water area	Channel
	International boundry

Scale: 1 in. ≐ 2 mi.

U.S. Fish & Wildlife Service - Nov. 1978

Figure 1D



Scale: 1 in. ≙ 2 mi.

U.S. Fish & Wildlife Service - Nov. 1978

Figure 1E

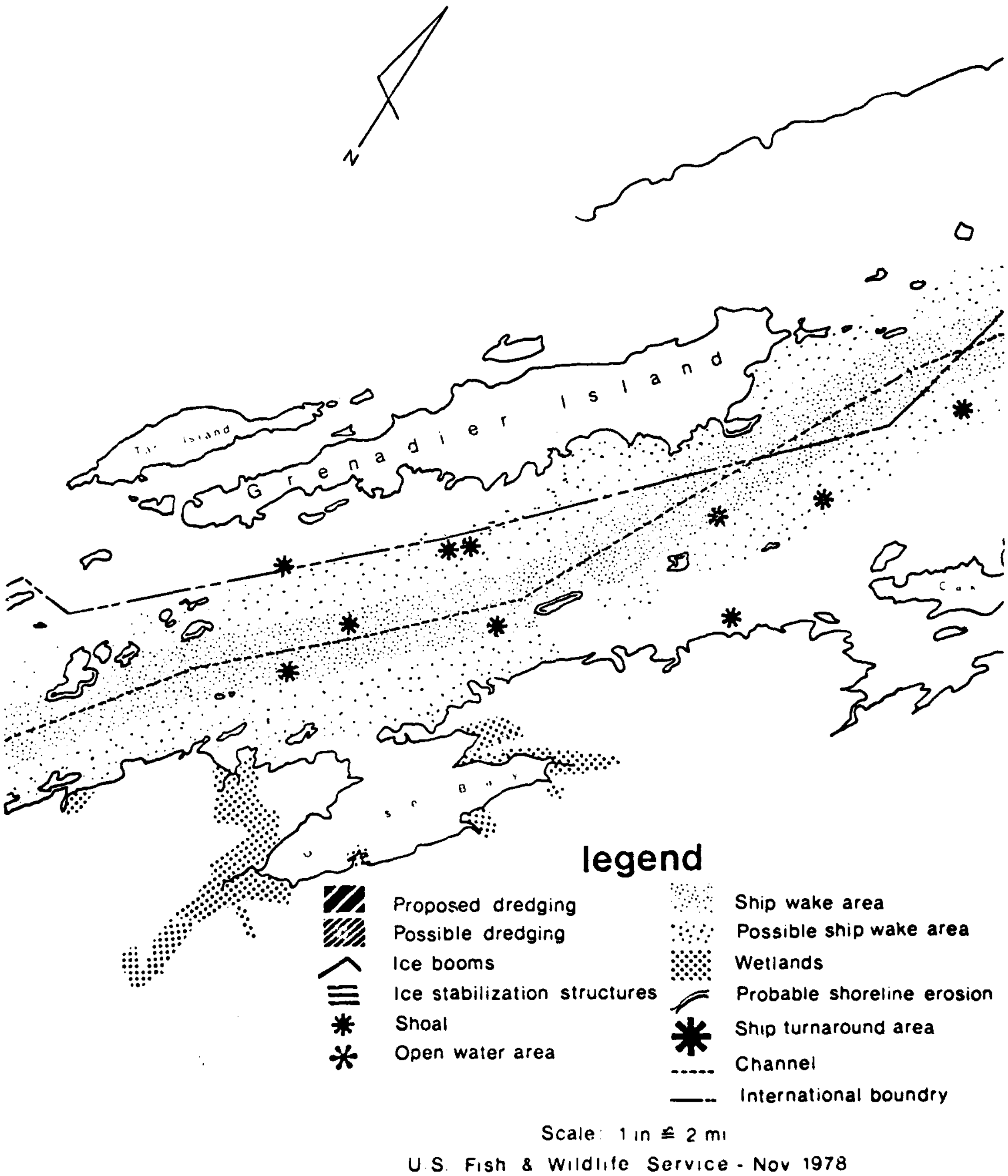
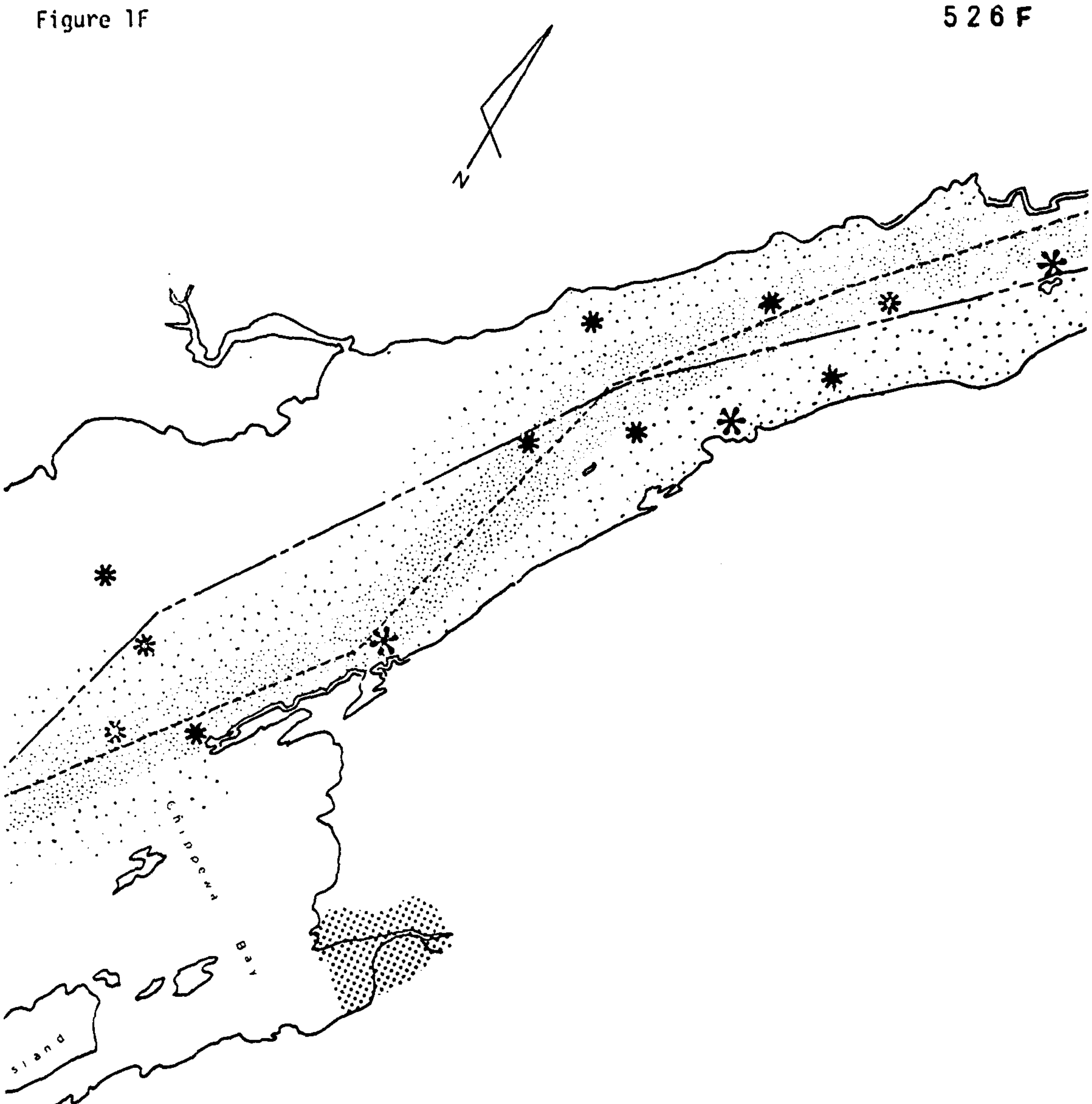

N
Grenadier Island
legend
Proposed dredging
Possible dredging
Ice booms
Ice stabilization structures
Shoal
Open water area
Ship wake area
Possible ship wake area
Wetlands
Probable shoreline erosion
Ship turnaround area
Channel
International boundry
Scale: 1 in ≙ 2 mi
U.S. Fish & Wildlife Service - Nov 1978

Figure 1F



legend

- Proposed dredging
- Possible dredging
- Ice booms
- Ice stabilization structures
- Shoal
- Open water area
- Ship wake area
- Possible ship wake area
- Wetlands
- Probable shoreline erosion
- Ship turnaround area
- Channel
- International boundry

Scale: 1 in. ≙ 2 mi.

U.S. Fish & Wildlife Service - Nov. 1978

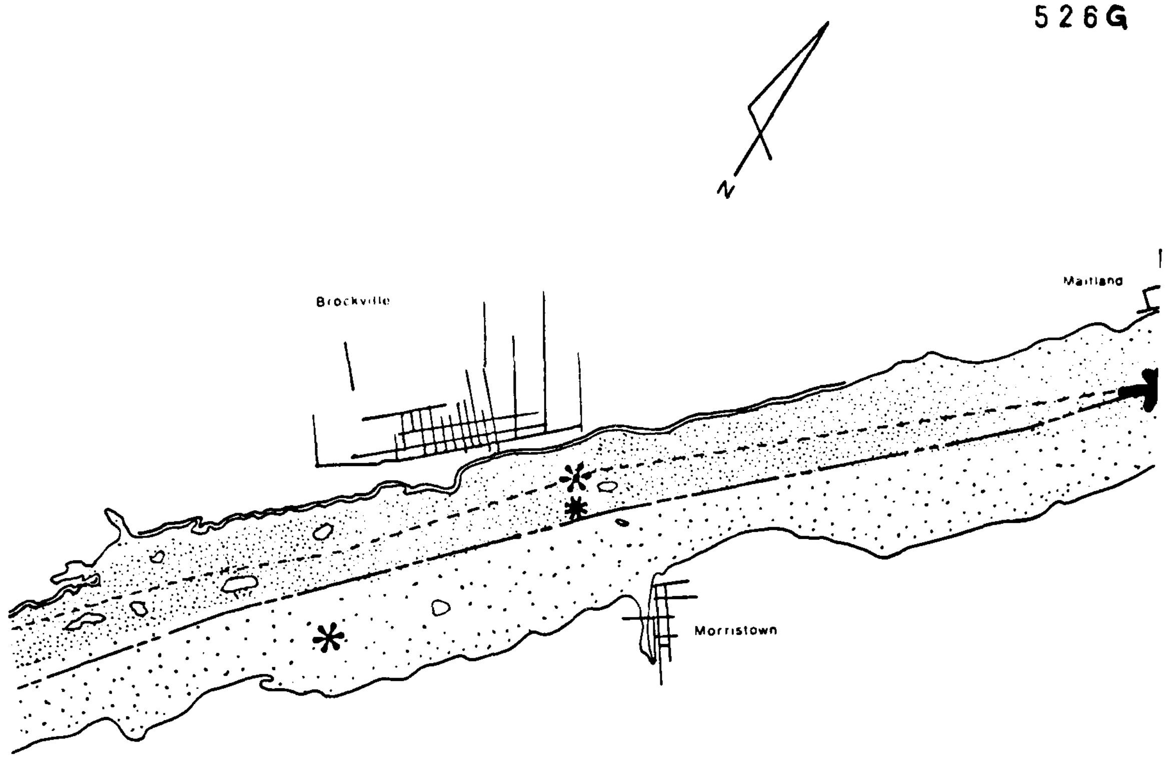
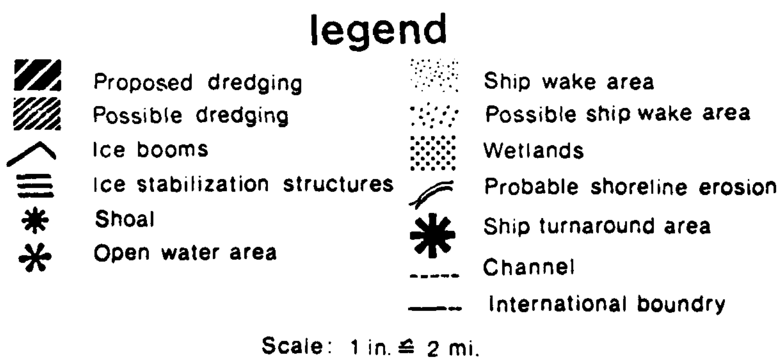


Figure 1G



U.S. Fish & Wildlife Service - Nov. 1978

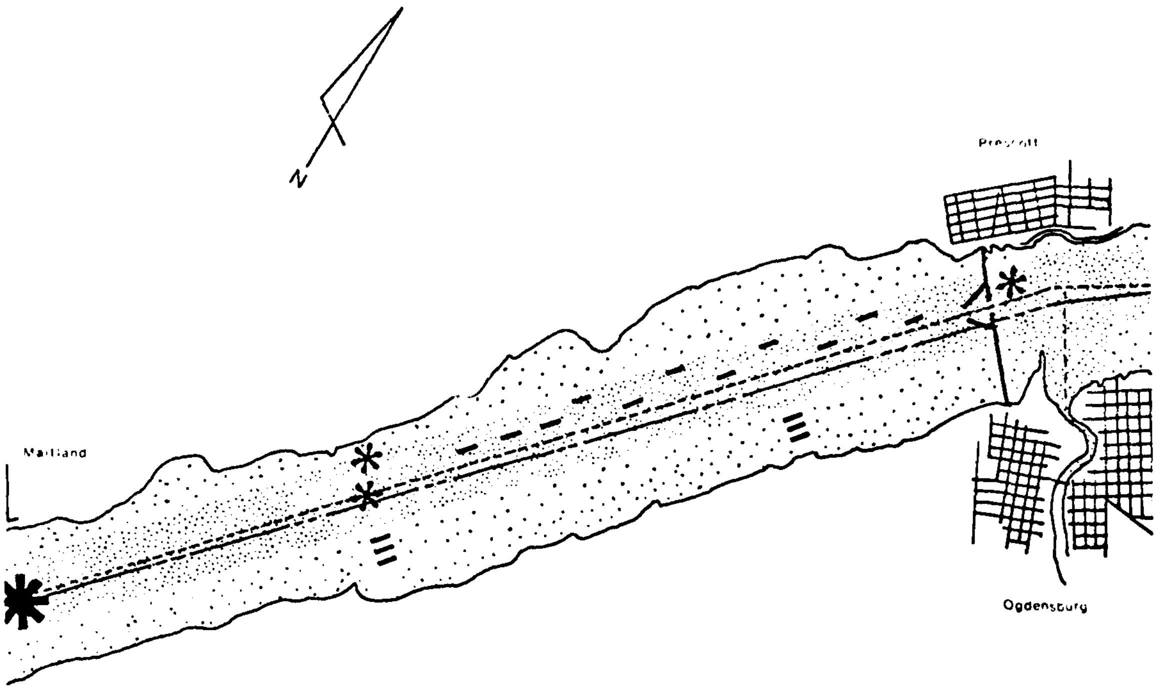


Figure 1H

legend

- Proposed dredging
- Possible dredging
- Ice booms
- Ice stabilization structures
- Shoal
- Open water area
- Ship wake area
- Possible ship wake area
- Wetlands
- Probable shoreline erosion
- Ship turnaround area
- Channel
- International boundry

Scale: 1 in. ≅ 2 mi.

U.S. Fish & Wildlife Service - Nov. 1978

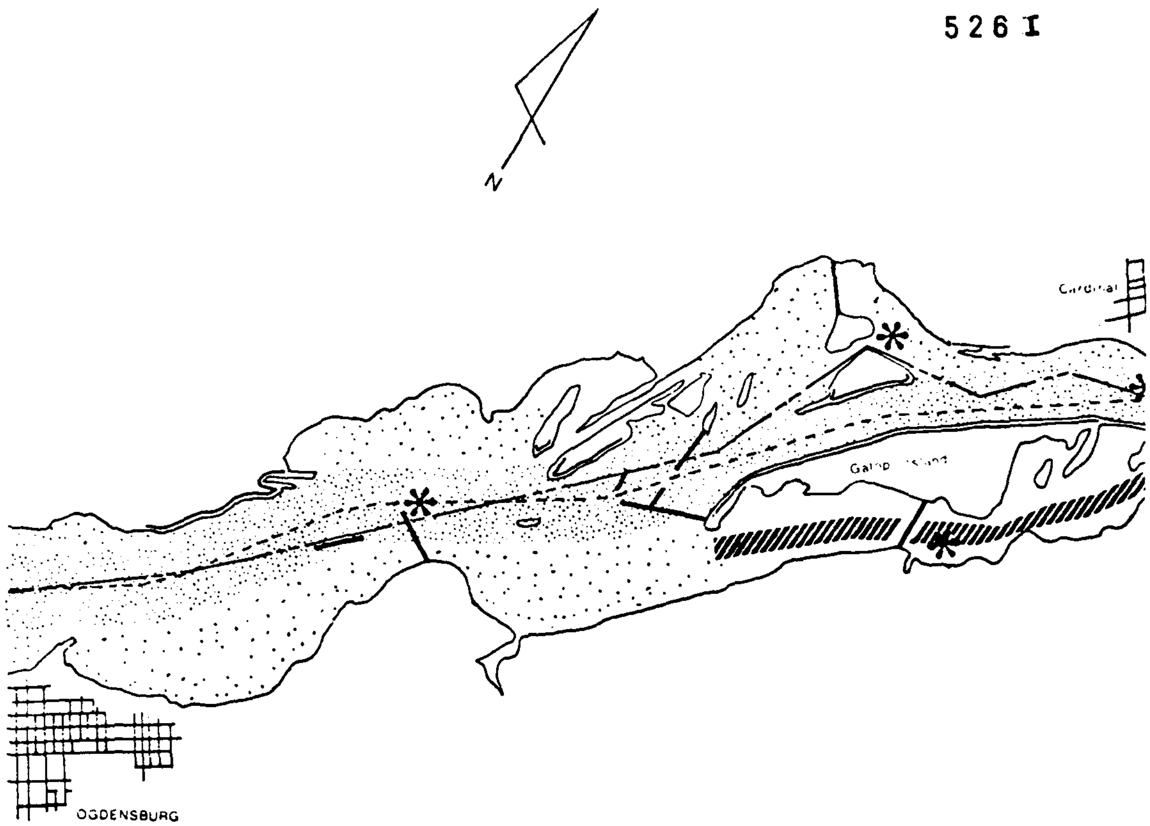


Figure 1-I

legend

Proposed dredging
Possible dredging
Ice booms
Ice stabilization structures
Shoal
Open water area
Ship wake area
Possible ship wake area
Wetlands
Probable shoreline erosion
Ship turnaround area
Channel
International boundry

Scale: 1 in. ≙ 2 mi.

U.S. Fish & Wildlife Service - Nov 1978

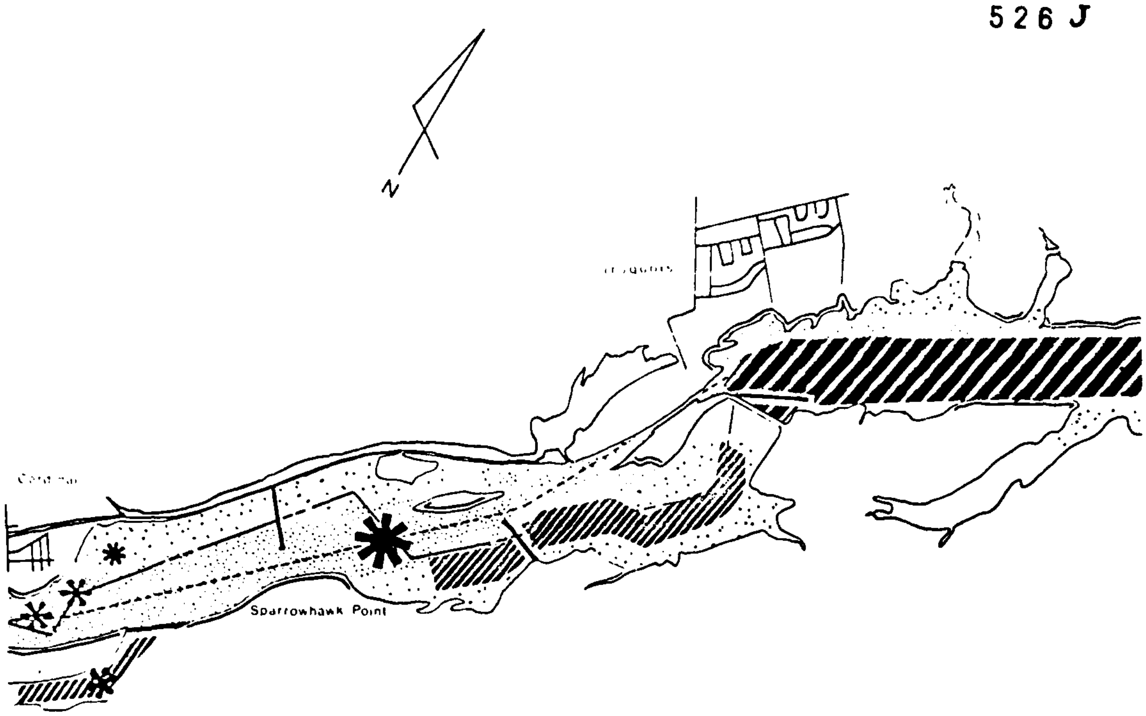


Figure 1J

legend

- Proposed dredging
- Possible dredging
- Ice booms
- Ice stabilization structures
- Shoal
- Open water area
- Ship wake area
- Possible ship wake area
- Wetlands
- Probable shoreline erosion
- Ship turnaround area
- Channel
- International boundry

Scale: 1 in. ≙ 2 mi

U.S. Fish & Wildlife Service - Nov. 1978

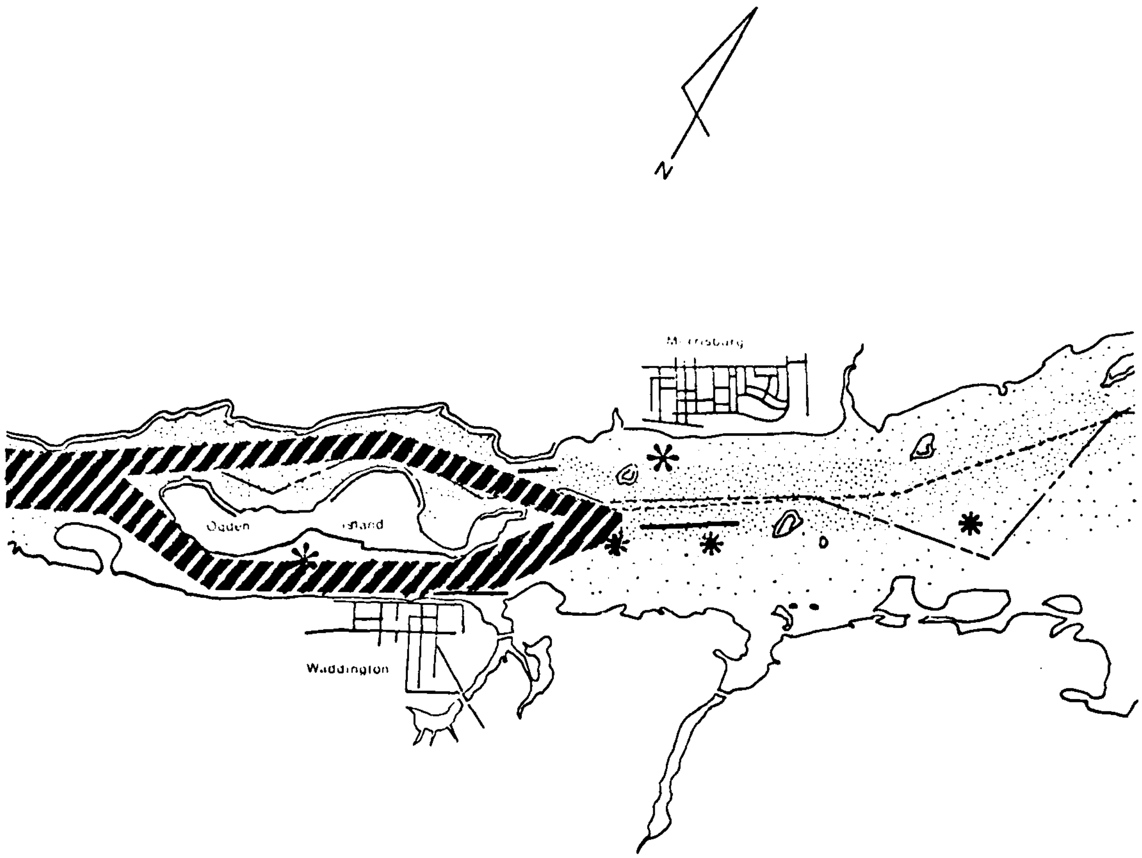


Figure 1K

legend

- Proposed dredging
- Possible dredging
- Ice booms
- Ice stabilization structures
- Shoal
- Open water area
- Ship wake area
- Possible ship wake area
- Wetlands
- Probable shoreline erosion
- Ship turnaround area
- Channel
- International boundry

Scale: 1 in. ≙ 2 mi.

U.S Fish & Wildlife Service - Nov. 1978

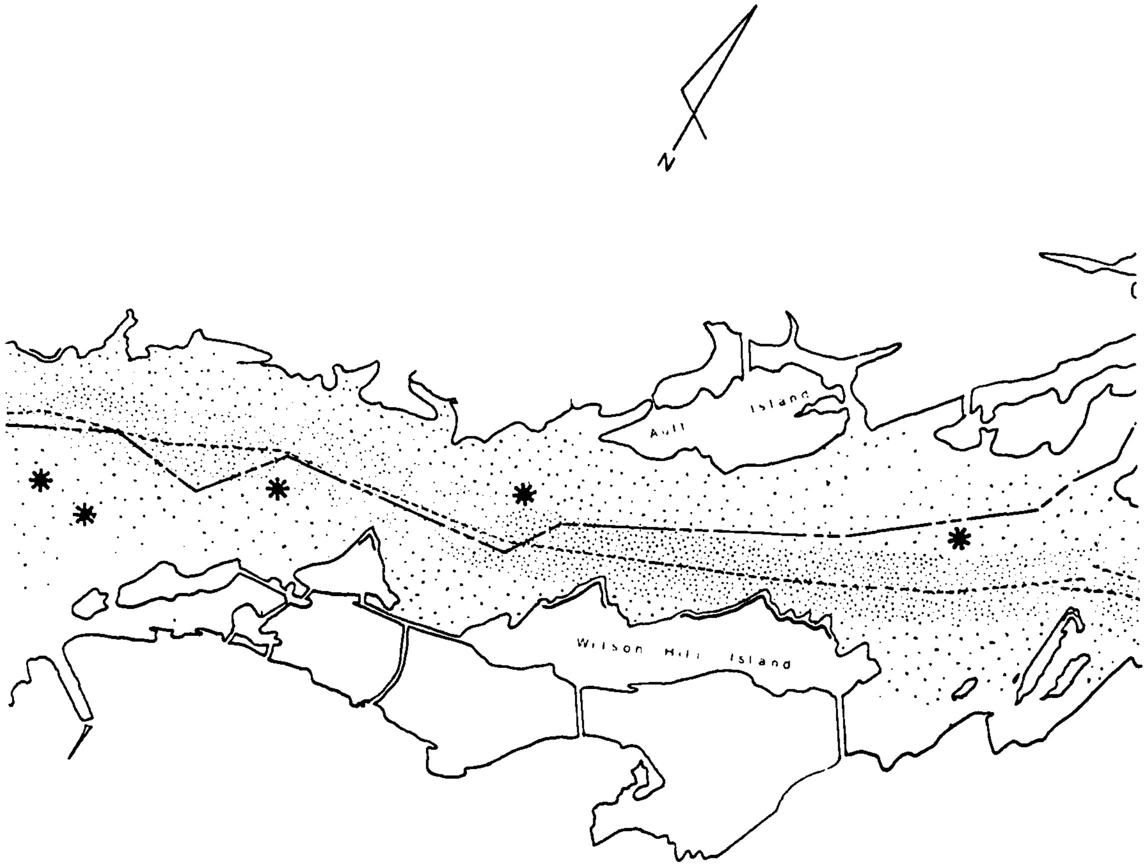


Figure 1L

legend

- Proposed dredging
- Possible dredging
- Ice booms
- Ice stabilization structures
- Shoal
- Open water area
- Ship wake area
- Possible ship wake area
- Wetlands
- Probable shoreline erosion
- Ship turnaround area
- Channel
- International boundry

Scale: 1 in. ≙ 2 mi.

U.S. Fish & Wildlife Service - Nov. 1978

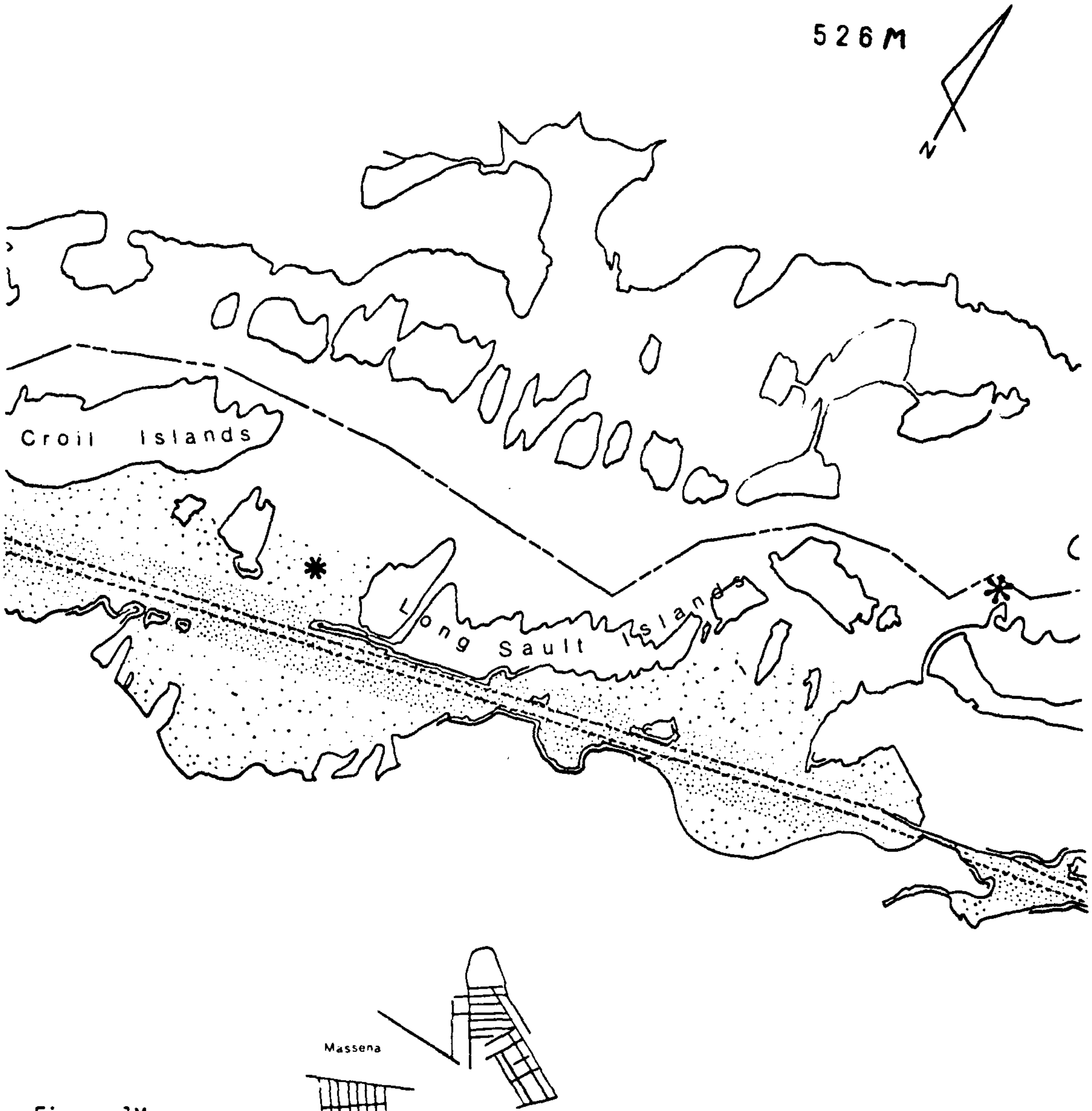


Figure 1M

legend

- Proposed dredging
- Possible dredging
- Ice booms
- Ice stabilization structures
- Shoal
- Open water area
- Ship wake area
- Possible ship wake area
- Wetlands
- Probable shoreline erosion
- Ship turnaround area
- Channel
- International boundry

Scale: 1 in. ≙ 2 mi.

U.S. Fish & Wildlife Service - Nov 1978

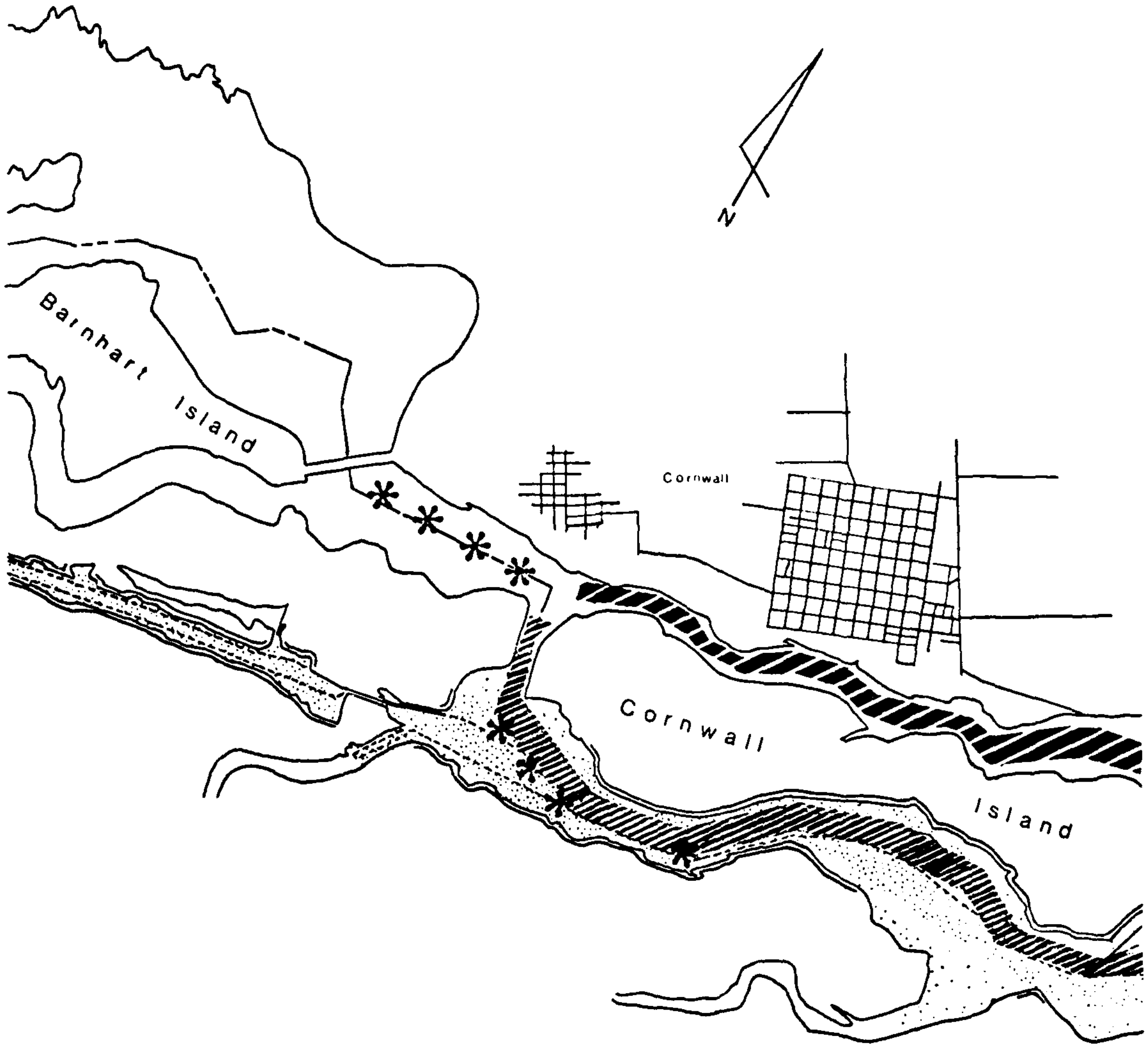


Figure 1N

legend

	Proposed dredging		Ship wake area
	Possible dredging		Possible ship wake area
	Ice booms		Wetlands
	Ice stabilization structures		Probable shoreline erosion
	Shoal		Ship turnaround area
	Open water area		Channel
			International boundry

Scale: 1 in. ≙ 2 mi.

U.S. Fish & Wildlife Service - Nov. 1978

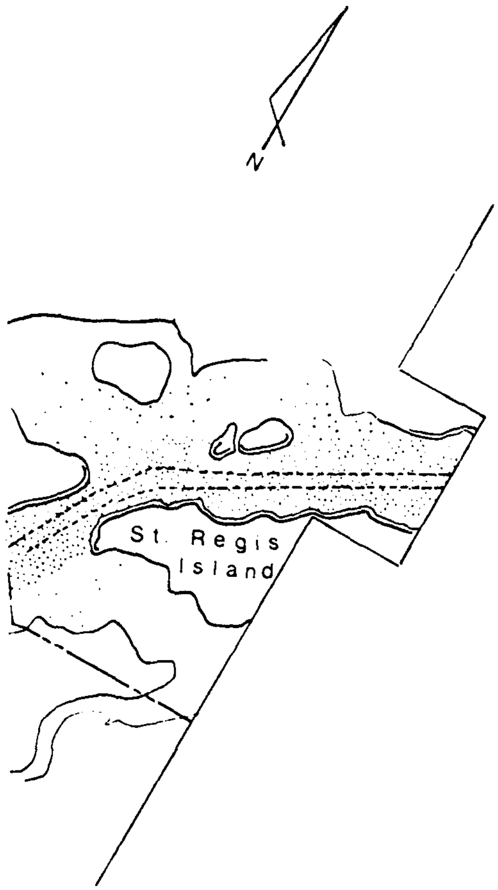


Figure 1-0

legend

- Proposed dredging
- Possible dredging
- Ice booms
- Ice stabilization structures
- Shoal
- Open water area
- Ship wake area
- Possible ship wake area
- Wetlands
- Probable shoreline erosion
- Ship turnaround area
- Channel
- International boundry

Scale: 1 in. ≙ 2 mi.

U.S. Fish & Wildlife Service - Nov. 1978

The Type B vessel is a major icebreaker which can break a 2 to 3 foot thickness of ice without backing and ramming while a Type C vessel is capable of doing the same to 1.5 to 2 feet of ice.

Several assumptions were made in preparing the icebreaking requirements identified in the July 1978 Survey Study, including:

(1) A 12-month navigation season.

(2) Normal (average) winter ice conditions, and

(3) That only vessels with a horsepower to length ratio of 6:1 or greater and properly designed, equipped, and strengthened for ice would operate in icebound areas. This assumes that the shipping industry would improve the ice transiting capability of their vessels.

Two Type C icebreakers are proposed for the St. Lawrence River, one to be stationed at Cape Vincent, the other at Ogdensburg. Initial channel clearing will require major icebreaker use. Powerful icebreaking tugs will be necessary should the program be implemented.

Icebreaker Mooring

The proposed icebreakers will require additional mooring facilities at Cape Vincent and Ogdensburg. The St. Lawrence Seaway Development Corporation is unable to identify the additional facilities needed for icebreaking tugs. Although specific detailed plans are not available, it appears that additional land acquisition and dredging will be required.

Vessel operators will continue to be responsible for damage to shore property and shoreline structures. The responsibility for determining the cause of damage is the Coast Guard's. Presently, no new speed limits are proposed. This may change if experience shows a reduction is advisable. Presently, riparian owners can only recover for damage to their property caused by vessels if there is proof of willful misconduct or negligence.

The Survey Study states that, "Therefore, although riparian interests might suffer increased shoreline erosion and shoreline structural damage as a result of the extension of winter navigation season, there appears to be no existing legal remedy for such damage."

Vessel Operating and Design Criteria

The Coast Guard draws its vessel hull strength and powering requirements from the American Bureau of Shipping "Rules for Building and Classing Steel Vessels." In regard to ice operation, however, these criteria are the responsibility of the owner and are at his option. Vessels may and do operate without these criteria in the winter.

The Coast Guard is currently conducting a study to determine what factors are involved in the setting of visibility standards. At present, no such standards exist.

Safety/Survival Requirements

This aspect of the program would not affect the fish and wildlife resources.

Pilot Access

There is a transfer point at Cape Vincent, New York, for the pilots required on vessels transiting the St. Lawrence River. If winter navigation is authorized, the two boats which currently transfer pilots to and from ships would have to be replaced by icebreaking tugs. These tugs would be powered by 700 horsepower engines and would be 50 feet in length.

Channel Clearing Craft

The thickness of channel mush ice could cause vessels to stall. A large, wide-beam mush ice clearing barge and towing vessel (possibly the buoyant-screw-type ice tractor) would be constructed to clear the channel. This vessel would reduce the amount of mush ice by sweeping the channel and pushing ice to each side. Two craft would be needed, one for Lake St. Louis and Lake St. Francis and the second for Lake St. Lawrence and the Ogdensburg-Prescott to Tibbetts Point reach.

Search and Rescue Requirements

Necessary assistance would be provided by all-weather aircraft and icebreakers.

Vessel Waste Discharge (NonHuman) Requirements

The Environmental Protection Agency (EPA) is responsible for the establishment and enforcement of standards for commercial vessels on the Great Lakes according to the Clean Water Act of 1977. These requirements include the equivalent of secondary treatment. No untreated wastes are to be discharged into the waters of the system. It is assumed that compliance with the aforementioned requirements will continue to be enforced.

The Maritime Administration in coordination with the Winter Navigation Board is currently contracting to obtain necessary technical expertise to study the effects of severe winter conditions on shipboard waste equipment and disposal at shorebased reception facilities.

Oil and Hazardous Substance Contingency Plans

The U.S. Coast Guard is the designated responsible agency for oil and hazardous substance contingency plans for the Great Lakes. The National Strike Force, a unit of the Coast Guard, is devoted to oil spill containment and reportedly has a four hour response time in the Great Lakes area. The cleanup of a spill is contracted out separately.

The potential for a winter spill is very real. From 1964 to 1968 there was an annual growth rate of 21.5 percent in the number of accidents involving domestic water carriers transporting hazardous materials (Marx 1971). The U.S. Army Corps of Engineers (1978) estimated that an oil spill is twice as likely to occur on the St. Clair and Detroit Rivers as it would be in the open sea. The Environmental Impacts of the Proposed Program, July 1978 Survey Study, states that the potential for oil or other pollutant spills is expected to increase during winter navigation.

Little is known regarding oil dispersal during winter, but it can be assumed that oil cleanup (a formidable task during the summer) would be extremely difficult during the winter due to the weather conditions under which the Contractors must work, and the unusual properties of ice and oil mixtures coupled with dispersal of some types of petroleum products under the ice cover. The July 1978 Survey Study states that, "Adequate mechanisms

are already in existence to handle oil and hazardous substance spills in the Great Lakes, winter and summer." However, a study of oil spill abatement in cold regions (Schultz and Deslauriers 1977) reports that there is no presently available device universally capable of recovering oil spilled on, beneath, or sandwiched within ice, under all ice conditions.

Ice Data Collection/Dissemination Systems

During the Winter Navigation Demonstration Program, an Ice Navigation Center was established at the Ninth Coast Guard District Headquarters in Cleveland, Ohio. The center receives and disseminates information on ice conditions, weather, and other information. This service is proposed to become a part of an operational Winter Navigation Program, should the program be enacted.

Ice and Weather Forecats

Ice and weather forecasts have been developed and implemented during the Demonstration Program. If the Winter Navigation Program proceeds, twelve site specific ice forecasts will be developed for critical bays, harbors, and channels.

Power Plant Protection

Additional power plant protection is not proposed for the St. Lawrence River beyond the proposed ice booms (see Ice Control Structures) which may help alleviate ice jamming. Traditionally, there has been a problem with jamming on the river. This was remedied by ice boom construction at Ogdensburg-Prescott and Galop Island.

Island Transportation Assistance

No transportation assistance has been proposed for the St. Lawrence River although many residents of Grindstone Island have expressed great concern over the loss of their means of cheap and convenient transportation.

Connecting Channel Operational Plans

These plans describe how island transportation would be carried out. As stated, none are proposed for the St. Lawrence.

Shoreline Protection

Little data are available concerning shoreline protection on the St. Lawrence River. The area is currently under study, and so far no protective measures have been proposed for the river. The studies are concentrating on identification of erosion prone areas, characterization of ship passage-induced impacts, and estimation of the potential magnitude of impacts. Structural and nonstructural means of protection are being evaluated. Studies are also concentrating on shoreline structure damage: the change in incidence and degree of damage incurred by shoreline structures due to winter navigation.

Water Level Monitoring

Winter navigation may cause changes in the levels and flows of the Great Lakes and St. Lawrence River due to ice jamming. The Environmental Assessment, FY 79 Winter Navigation Demonstration on the St. Lawrence River, identified a possible increase in Lake Ontario water levels of one foot if as many as five ship passages a day occurred. Ice jamming would also cause a reduction in levels and flows downstream of the jamming point. Ice jam alert monitoring programs have been established for the St. Clair River, Detroit River, and St. Mary's River but not for the St. Lawrence River.

Dredging

Dredging as discussed in the July 1978 revision of the Preliminary Draft Survey Study, Corps of Engineers, Appendix B, Formulation of Detailed Plans, included the removal of approximately 34.5 million cubic yards of material in the reach between Ogdensburg-Prescott and Morrisburg (Figures 1 and 2). This would occur in areas (total length approximately 45,000 feet) which have average river flow velocities in excess of 2.6 ft/second. Figure B-59 identified Ogden Island as the disposal site. The Proposed Plan section in the Main Report states that Ogden Island is a previously used disposal site.

Dredging in the Cornwall-St. Regis Island reach is discussed in the Main Report section:

> "Within the Cornwall-St. Regis Island reach there are a number of areas, totaling approximately 25,000 feet in length, which have average river flow velocities in excess of 3.9 feet per second. Approximately 20.0 million cubic

> yards of dredging is being considered to increase the channel cross-sectional area and thus reduce the average velocity to 2.25 feet per second and encourage the growth of a stable ice cover."

Figure 3 delineates the area. Appendix C-III, Adverse Environmental Effects Which Cannot be Avoided, superficially discusses dredge disposal in regard to potential impacts; disposal would occur on upland sites which have not been identified.

The St. Lawrence Seaway Development Corporation's August 1978 St. Lawrence Seaway System Plan for All-Year Navigation, Appendix C-Environmental Impact, Arctec, Inc., estimated necessary dredging to reduce flow velocity to 2.0 feet/second (in contrast to the Corps' figure of 2.25 feet/second). This would involve 50.6 million cubic yards of material (Figure 4) in the Ogdensburg-Morrisburg reach and 33.8 million cubic yards (Figure 5) in the Cornwall-St. Regis Island reach.

In addition to dredging to reduce flow velocity, dredging would be required for installation of anchors for fixed navigation aids and ice booms.

Plans for ice boom modification, as identified in Great Lakes-St. Lawrence Seaway Navigation Season Extension, St. Lawrence River Demonstration Program Fiscal Year 1979, May 1978 SLSDC, indicate that 4-6 additional anchors would be needed to strengthen the Main Galop boom:

> "As presently envisioned, the supplemental anchors will be identical to the mud anchors presently used to secure the boom. Each anchor measures 12 feet by 12 feet and is

loaded through a flanged steel beam 25 feet long. Installation of each anchor will require the excavation of a trench in the riverbed approximately 15 feet deep, 15 feet wide, and 23 to 25 feet long. The volume of material involved with the installation of one anchor is approximately 200 cubic yards. Benthic surface area involved with the actual excavation is approximately 40 square yards. However, placement of the excavated materials on the riverbed adjacent to the trench in preparation for backfilling would affect an equivalent surface area of the riverbed."

Appendix B, July 1978 Preliminary Survey Study reports:

"In addition to the Ogdensburg-Prescott and Galop Island booms, there would be nine additional booms placed in the St. Lawrence River between the Ogdensburg-Prescott bridge and Morrisburg, Ontario, six upstream from the Iroquois Dam and three downstream. The booms would vary from 1,200 feet long to 6,000 feet long and would be both heavy and light duty types, depending on location."

Anchor placement would be required. Figures for the numbers of anchors and displacement of bottom material are not presented.

The removal of floating aids to navigation would require a replacement system of fixed aids (Survey Study Working Preliminary Draft, Corps of Engineers, July 1978). The SLSDC 1975 System Plan, Appendix C, states that: ". . . a fixed aid would be required to mark turns where shoal water is nearby. In relatively straight river reaches, a fixed aid would be required every two or three miles."

The July 1978 Survey Study identified a need for 12 fixed aids, 2 ranges, and 19 radar reflectors for existing fixed aids (Appendix B); the configuration of the Ontario Harbors is such that additional aids are not required. Figures for displacement of material involved in installation have not been calculated.

Dredging would also be required for moor facility construction. Erie, Pennsylvania; Rochester, New York; Ogdensburg, New York; Oswego, New York; and Cape Vincent, New York, were identified by the July 1978 Corps Survey Study as requiring Type C vessel mooring facility construction. Further details involving the facilities' construction and required dredge and disposal are not given.

Air bubblers and bubbler/flushers may be used in conjunction with lock modifications and thermal effluents. No description has been given on how these systems would be implemented and how much bottom area would be destroyed if dredging were required.

As identified in the Corps' July 1978 Survey Study, Appendix B, shoreline erosion protection and shore structure protection are under study. Devices to provide such protection may require dredging for implementation. Further details are not available regarding this aspect.

Lock Modifications

Winter weather causes problems in lock operation; ice builds up on lock walls and floating ice accumulates within the chamber. To combat these problems, several modifications and improvements are proposed.

The July 1978 Survey Study identified four categories of problems for the St. Lawrence River:

1. Lock wall icing,
2. Gate icing,
3. Ice in the lock chamber, and
4. Equipment failures.

The study also identified the following proposed solutions:

> "The improvement necessary to handle lock wall icing consists of heating the lock wall by installing heating coils in the walls. With this system, the temperature would be maintained just above freezing and hence prevent any ice from clinging to the lock walls under most winter conditions. The improvements necessary to handle gate and gate component icing consists of heating the mating edges of the gate and replacing the existing contract blocks with heated contact blocks. The improvements necessary to handle ice in the lock chamber are the installation of flow developers along the approach walls, and the construction of a diversion channel around the lock with an ice crusher and flow control weir. The improvements necessary to handle the probable higher incidence of equipment failure would require that all equipment and lock subsystems be kept in a high state of maintenance, that extensive equipment redesign be undertaken, and heated enclosures be provided for equipment and personnel.
>
> To operate and maintain lock facilities and ice booms on the St. Lawrence River two tug boats would be needed. The existing SLSDC tug ROBINSON BAY would have to have a new stainless steel propeller installed and an air lubrication system installed for the hull. Also, a second new icebreaking tug is proposed."

Further details regarding construction and engineering data are not given. These modifications would be required for the two U.S. Locks, Eisenhower and Snell. They would also apply to the five Canadian locks. Appendix B, Engineering Problems/ Alternative Solutions Table, St. Lawrence River (Figure 1) reports that several modifications have been or will be completed. Installation of bubbler-flushing system behind each gate is done at both Snell and Eisenhower. Installation of ice control devices at upstream lock entrances (air curtains) has been completed at Snell and is underway at Eisenhower. Installation of an ice flushing port in locks is underway at Eisenhower.

If winter navigation in the river were extended to 12 months, additional locks would be required since maintenance necessitates the periodic closing of the existing locks. The Additional Locks and Other Navigation Improvements Study proposes two alternative plans, the twinning of existing locks or the construction of a new channel and lock.

Air Bubbler System

Channel bubbler/compressors have been proposed for the St. Mary's River to inhibit or reduce the ice formation at various tight-turn areas. The bubbler pipe would emit air at a pressure of 10 to 15 pounds per square inch in an area adjacent to the vessel track. The air would be compressed by a 375 cubic foot per minute diesel powered compressor with a second compressor as back up.

This type of bubbler has not been proposed for the St. Lawrence River; however, the July 1978 Survey Study, page B-28, identified a bubbler-flusher system which will be used behind the gates in the Eisenhower Snell Locks. There are not details concerning these structures (possibly since installation has already occurred);

however, it is assumed that these air bubblers work on the same principle as those described for the St. Mary's River.

Aids to Navigation

Traditionally, buoys are removed for the winter season to prevent damage or loss of the aids. An improved system of fixed lighted aids is therefore proposed should winter navigation be put into effect. The July 1978 Survey Study identified the need for 12 fixed aids, 2 ranges, and the addition of 19 radar reflectors to existing fixed aids. The improved system of both lighted aids and radar should improve navigability during poor weather.

The St. Lawrence Seaway Development Corporation (SLSDC) in its 1975 SPAN report, states that in straight river reaches a fixed aid every two or three miles would be adequate.

The installation of the aids will involve bottom sediment disruption. The excavation necessary is not known but has been estimated to be more than that required for ice boom anchor installation.

Ice Control Structures (Ice Booms)

On the St. Lawrence River, cross channel ice booms have been used since 1959 to promote a stable ice cover and reduce the likelihood of ice jamming. This has been considered vital to the Power Authority State of New York in maintaining suitable flow for power production.

If the Winter Navigation Season Extension occurs, the proposal is to reconstruct and gap the Galop Island boom and relocate, reconstruct, and gap the Ogdensburg-Prescott boom. The gaps of both would be approximately 250 feet in width.

The Ogdensburg-Prescott boom would be approximately 2,000 feet long, constructed of the heavy duty type "catamaran" floats. The navigation gap would be equipped with sections of light duty booms approximately 1,000 feet long running parallel and upstream from each boom end. The light duty booms would theoretically resist the tendency of the ice field to break off due to vessel passage through the gapped boom.

The Galop Island boom would be approximately 3,300 feet in length and consist of the heavy duty type "catamaran" floats.

Additionally, there would be nine booms placed in the river between the Ogdensburg-Prescott bridge and Morrisburg, Ontario; six upstream from the Iroquois Dam and three downstream. The booms would vary from 1,200 feet to 6,000 feet long and would be both heavy and light duty types depending upon location.

Anchorage of the booms is not discussed in the July 1978 Survey Study; however, three types of anchors are presented in diagrammatic form (Figure B-12): embedded chain anchors, H-pile anchors, and mud or clay anchors. The embedded chain anchors are a permanent anchorage requiring the construction of a 6" diameter drilled hole filled with concrete. The depth of the hole required varies from 10-30 feet. The H-pile anchor is also permanent and requires driving the pile 10-30 feet below ground. One to four vertical piles would also be used. Dimensions of the pile are not given. The mud anchors may be removed and replaced annually if necessary. It is this type which currently secures the booms on the St. Lawrence River. The anchors currently used measure 12 feet by 12 feet. Installation of these anchors requires the excavation of a trench in the riverbed approximately 15 feet deep, 15 feet wide, and 23 to 25 feet long. The volume of material involved in installation of one anchor is approximately 200 cubic yards. Benthic surface area involved in excavation is about

40 square yards, with additional disturbance of benthic areas if the excavated material is deposited within the river.

It is not known how many anchors will be used in the installation of the booms as boom configurations have not been defined. It is also not known what type of anchorage will be used. It is known, however, that polluted sediments occur within some of the boom site areas, and dredging or disruption of this bottom material may not be feasible.

Thermal Effluent Ice Suppression

Although this action is not currently under consideration, at various times throughout the program the addition of thermal wastes for ice formation suppression has been considered. The SLSDC SPACN Study identified three areas which would require additional heat to minimize ice jam problems: the Beauharnois Canal, the area between Lake St. Francis and the Moses-Saunders Dam, and the area between Ogdensburg, New York, and Morrisburg, Ontario. The heat energy necessary to suppress ice in these areas requires power generating plants of the following capacities: a 3,600 megawatt plant at the upstream entrance of the Beauharnois Canal, a 1,450 megawatt plant at Massena Point, and plants at Chimney Point and Iroquois with generating capacities of 1,500 megawatts and 1,000 megawatts, respectively.

Elements of each system would include:

1. an intake system which supplies cooling water to the thermal plant;

2. a winter diffuser system which returns the cooling water to the river and distributes it along the bottom of the river and parallel to the navigation channel; and

3. a summer diffuser system which returns the cooling water to the river and distributes it so that little or no local heating of the water occurs.

Environmental Plan of Action

Since we recommend against winter navigation on the St. Lawrence River as currently proposed, no EPOA should be developed unless major modifications are possible in proposed project plans.

C. Fish and Wildlife Resources

1. Without the Project

a. Primary Production

Primary producers in the aquatic ecosystem are phytoplankton, periphyton, and aquatic macrophytes. These form the basis for the remainder of a complex food web. Modification in the primary producer populations, in terms of distribution and abundance, have resulting system-wide effects on higher trophic levels. The dynamics of this system-wide ecology cannot be overemphasized.

During 1976, the total of 103 phytoplankton species were identified from the St. Lawrence River. Phytoplankton were found to exhibit the most species diversity and greatest abundance close to the River's origin at Lake Ontario. This indicates that a substantial amount of the phytoplankton biomass enters the River from Lake Ontario. The declining density of this biomass as it moves downstream suggests that the level of primary production contributed by the River itself is low.

Perphyton, which grow on a variety of submerged substrates, include a heterogeneous and complex association of primary producers. Major contributors to the periphyton community appear to be diatoms, green algaes, and Cladophora. Attached and free-floating aquatic macrophytes had higher biomass estimates in undisturbed as opposed to disturbed aquatic habitats.

There is a seasonal change in the abundance of secondary producers, i.e., zooplankton. Zooplankton are important in transferring the energy fixed by the primary producers to the next higher trophic level, the planktivorous fish. Eighty percent of the winter zooplankton population consists of cyclopods. Rotifers predominate from ice-out to early June. Cyclopoid copepods then become most abundant, while in July cladocerans are predominant. It is not known how seasonal fluctuation in either abundance or species distribution of zooplankton affects the feeding ecology of fish.

The abundance and distribution of benthic invertebrates may be influenced by the level of enrichment of bottom sediments. The presence of certain forms depends on their tolerance, while their abundance is related to available food resources. Amphipods, or scuds, are common in samples taken from throughout the River. These organisms are substrate feeders and are considered excellent food for planktivorous fish.

b. Littoral Vegetation

Wetland communities along the River shoreline, shoals, island, and tributaries range from those dominated

by deepwater macrophytes to those dominated by seasonally flooded shrub systems or swamp forests. The species composition of each community is determined mainly by water levels with communities often merging almost imperceptibly into one another with changing water depth.

Deepwater aquatic communities are dominated by eel grass, flatstem pondweed, coontail, waterweed, and water starflower. Shallow water areas are dominated by various pondweed, duckweed, and milfoil. Production increases dramatically over that in deeper water. Extensive productive cattail communities dominate the leading edges of emergent meadows where substrates are covered by water in the spring and summer.

Sedge, burreed, and smartweed are often associated with the cattails.

c. Icthyoplankton and Inshore Larval Fish

Fish are inclined to very high mortality rates during their early life history or larval stages; to compensate for this they produce excessive numbers of eggs. Summer samples of icthyoplankton reveal that the alewife completely dominates all other forms. The pumpkinseed, bluegill, and yellow perch are the only other forms present in any number at all. Limited winter sampling at four sites has yielded the eggs or larvae of yellow perch, rainbow smelt, alewife, and burbot. Yellow perch was the most abundant species while burbot was the only winter spawner. Collection data suggest that littoral and inshore areas are of great importance as spawning or nursery areas.

d. Adult Fish Community

The St. Lawrence River supports a large and diverse fishery that plays an important role in the regional economy. Presently, 120 species are thought to occur in the River and associated watershed. The International section of the River has yielded 99 different species while literature surveys and distributional data suggest that an additional 21 species found nearby may stray into the area.

Since fish are dependent upon primary and secondary producers in the River, an understanding of their feeding ecology is necessary to relate limnology to fish distribution. Preliminary studies on 10 species indicate that as adults the fish can be characterized as: planktivores (alewife), priscivores (smallmouth bass, largemouth bass, and northern pike), and omnivores (brown bullhead, yellow perch, rockbass, black crappie, pumpkinseed sunfish, and white perch). Surprisingly, stomach content analysis yielded very few larval fish but, periodically, high numbers of invertebrate eggs. Major dietary components of fishes over 100 millimeters long were molluscs and amphipods.

Studies of angling pressure along the River are largely unavailable. In a 1976 statewide pilot study, however, there were 596,000 angler days on the River in 1973. The St. Lawrence River ranks at the top of the list of all New York State waterways for total harvest of largemouth bass, northern pike, and muskellunge, and second in the harvest of smallmouth bass, panfish, and bullheads.

The economic contribution of the sport fisheries is substantial. During 1973, anglers in the River region spent an estimated $4.9 million on fishing and related activities, $2.0 million in travel-related expenditures, and an additional $5.0 million on the purchase of major equipment.

Ice fishing derbies on the St. Lawrence appear to account for a large portion of the total recreation activity that occurs during winter. Yellow perch are usually caught in the greatest numbers at these derbies, though pike are the most sought after.

e. Insects

Insects, which frequently serve as the prey items of waterfowl, fishes and mammals, are important links in the food web. Aquatic insects are also reliable indicators of pollution and ecosystem stability. Preliminary sampling in wetland, benthic, littoral, and terrestrial areas revealed that three groups dominate the results. These are the mayflies (Ephemeroptera), caddisflies (Tricoptera) and midges (Diptera, Chironomidae).

f. Decomposers

Although the presence of several groups of benthic invertebrates that frequently serve as decomposers has been noted in various localities along the St. Lawrence, their role has not been thoroughly determined. It has been noted that oligochaetes, chironomids, and nematodes appeared to be associated with the enriched conditions found below sewer and industrial waste outfalls.

g. Plant Communities

Vegetation along the St. Lawrence may be divided into three broad categories: upland, wetland, and deepwater. The continuum of environmental factors and species composition make delineation of the three categories difficult at times.

Studies indicate that 22% of the shoreline area in Jefferson and St. Lawrence counties is comprised of successional fields while forests occupy 10% to 23%, respectively, of the area. Most of the forest areas have been disturbed at one time or another. Fragile plant communities on rock outcrops in wetlands occur in 13.2% and 40% of the respective counties.

Upland areas along the St. Lawrence are characteristically comprised of successional fields, shrubby fields and shrublands, and forested areas. Wetland areas can vary from emergent meadows totally dominated by cattails to periodically flooded hardwood forests. Deepwater communities, where plant distribution is influenced by turbidity, substrate character, and wave and current action, are found along islands, shoals, and the mainland. Productivity is invariably low in these areas.

h. Reptiles and Amphibians

Twenty-two species of reptiles and amphibians were captured during initial field wrok in 1976. Data from the literature suggest that as many as 34 species may occur overall. All species are important components of the food web since they consume large quantities

of plant, insect, and other small animal life. Many of them feed both on land and in water, and are themselves consumed in both environments. Thus, they bridge the gap between two contrasting habitat types. Amphibians and reptiles (turtles) overwinter beneath the winter ice cover, buried in the mud along the cattail-open water edge of marshes. Disturbance of destruction of these areas could dramatically affect the overwintering survival rate of these animals.

i. Birds

Over 260 birds species regularly visit the River. A majority of these occur as migrants with few birds breeding and even fewer overwintering. The Federally-endangered bald eagle is an important winter resident in the area and is dependent on the presence of open water pools in the ice cover where it feeds on fish and wintering waterfowl.

Several species of gulls and terns nest on small islands in the River. They are dependent upon the concentrations of small fish found near islands and shoals for food.

Waterbirds (loons, grebes, herons) and waterfowl (swans, geese, and ducks) are frequently seen on the River and in its associated aquatic habitats. Waterfowl hunting is economically important in the River region. Raptorial birds (hawks, owls) are in the upper levels of the food web and are sensitive to environmental perturbations. Thus, they are indicators of environmental quality.

j. Mammals

Nearly 50 species of mammals occupy the St. Lawrence River valley. Many of them are semi-aquatic or dependent upon the River and its associated habitats. Species diversity ranges from white-tailed deer to meadow mice. Cottontail rabbits, squirrels (red and gray), red foxes, raccoons, woodchucks, stripped skunks, and eastern chipmunks are abundant, while deer, mink, muskrats, beaver, porcupines, coyotes, and snowshoe hares are common. Less commonly occurring mammals include gray foxes, fisher, long and short-tailed weasels, river otters, and bobcats.

In addition to occuring on the mainland, as many as 18 species may be residents on the larger islands in the River including rabbits, foxes, skunks, squirrels, woodchucks, coyotes and raccoons, as well as voles and shrews. In winter the prevailing ice cover on the River permits mainland mammals to expand their foraging range to numerous islands unavailable during warmer seasons.

k. Consumptive and Nonconsumptive Uses of Resources

Many varied types of recreational activities are popular along the St. Lawrence and draw people primarily from the metropolitan centers in New York, Ontario, and Quebec as well as from all over the world. Fishing, boating, camping, hiking, hunting, picnicking, and sightseeing are all prominent tourist drawing activities available in the St. Lawrence River valley.

Since 22% of New York's total waterfowl population utilizes or follows the St. Lawrence during migration, it follows that waterfowl hunting is a popular pastime in the region. The waterfowl are able to utilize significant acreages of undeveloped, privately-owned wetlands that exist along the River. Worth noting is the fact that most of these areas have a high wildlife enhancement and public acquisition potential.

On terrestrial sites farm-game species occur in varying densities along the river valley and hunters pursue what is available. Cottontail populations vary fromn low to exceptionally high densities while ring-necked pheasants and mourning doves are scarce. A fairly stable, huntable population of Hungarian partridge persists in several of the more active farming areas. White-tailed deer populations never reach high levels as their numbers are controlled by dogs and poachers.

In 1970, thirty-five thousand hunters were active in the St. Lawrence River basin and this number was expected to increase to forty-one thousand by 1980. However, New York State Department of Environmental Conservation records show that over 63,300 hunting and trapping licenses were sold in the three county study area in 1974-75. It is estimated that by 1980, twenty-eight thousand acres of wildlife habitat will be needed to satisfy the demands of hunters in the St. Lawrence River basin.

Trapping for furs, another consumptive demand on wildlife, is important in the St. Lawrence River valley. Recent studies indicate that muskrat pelts taken from within one mile of the River in Jefferson and St. Lawrence Counties have at least a one million dollar value per year (at 1978 prices of $5.00 per prime muskrat pelt). Pelts of other species, excluding the raccoon, comprise less than 2% of the total fur harvest in a segment of the River.

A major portion of the fisheries of New York State are harbored in the St. Lawrence River and a multimillion dollar sport fishing industry is supported by this resource which is characterized by both warm and cold-water stocks.

Smallmouth bass are consistently the most important species in terms of catch, economics, and angler preference. Northern pike are second in preference, followed by yellow perch which are highest in total catch. Second in catch, though not in preference, is the rock bass. Finally, muskellunge is fourth in preference though the catch rate is low relative to the effort expended.

In winter, recreational activities along the St. Lawrence are primarily oriented toward ice fishing. Although it does not appear to be a major stimulus to the economy, ice fishing is actively pursued by a small segment of the population as both a recreational and social activity.

The Thousand Islands section of the River provides a focal point for aquatic sports at eleven state parks. The Robert Moses State Park near Massena received the highest attendance of all public recreation areas in the region during 1965; many visitors undoubtedly came to view the Eisenhower Lock or swim at the white-sand beach.

Active warm weather use of the water includes boating, water skiing, and swimming while more passive activities include viewing at vantage points along the shore or driving along shoreline highways where the water is visible. The area also forms a backdrop to other leisure time activities which concentrate along its border; these include: camping, sunbathing, strolling, picnicking, bicycling, horseback riding, golfing, birdwatching, nature study, and wildlife photography. No data are available which estimate the economic stimulus these activities provide for the area.

Endangered Species

The Endangered Species Act of 1973, Public Law 93-205, as amended, lists as endangered the following species which are found in the St. Lawrence region:

1. Bald eagle (*Haliaeetus leucocephalus*)
2. Peregrine falcon (*Falco peregrinus*)
3. Indiana bat (*Myotis sodalis*)

New York State has also published a list of protected plant species (Section 193.3, Environmental Conservation Law Section 9-1503), and the U.S. Department of the

Interior has developed a list of endangered and threatened plant species. Inventories of the aquatic and emergent plant species in the study area are not available.

2. With the Project

Various features of the proposed project would impact the River in many ways, some of which would be overlapping. For purposes of simplification the following paragraphs discuss impacts under applicable project features. It should be borne in mind that the insult to various equivalent parts of the system would be multiplied as each project feature is implemented, and although some features individually may not exhibit the severity of impacts anticipated, collectively they would.

Initial Track Icebreaking and Channel Maintenance

Traditionally, the Coast Guard has provided icebreaking support and assistance for commercial vessels operating in winter. The breaking of the initial vessel track through the winter ice cover will require large Type B vessels. The powerful icebreakers will create turbulence and currents in the main channel, suspending and resuspending sediments. This could adversely affect benthic communities and submerged vegetation for great distances from the main track depending on current velocity, bottom configuration, and bottom composition. Effects of icebreaker passage, either for initial track breaking or for channel maintenance, on ice cover characteristics, habitat types, water levels, and flora and fauna of the River will be discussed under Navigation Traffic.

Icebreaker Mooring

Additional icebreakers proposed for the St. Lawrence River and Lake Ontario will require expanded mooring facilities at Rochester, Oswego, Cape Vincent, and Ogdensburg. If this necessitates additional dredging at the mooring sites, for the installation of ice booms, or for an improved access channel, fish and wildlife resources will be lost. Both dredging and repeated use of the access channel by the powerful vessels will generate suspended sediments that will cover and destroy adjacent benthic communities and littoral vegetation. Dredging itself will destroy benthic organisms and benthic habitat. If harbor sediments are polluted, as is known for Ogdensburg Harbor sediments, dredging and propeller turbulence will release toxic materials such as oil and grease, chromium, lead, copper, zinc, nickel, and mercury to the aquatic environment. This will expose aquatic, semi-aquatic and water-dependent biota to the potentially lethal effects of these materials. Plankton, periphyton, benthic invertebrates, and rooted macrophytes are all capable of concentrating subacute levels of toxic substances which are in turn passed on to secondary consumers: fish, birds, and mammals. Disposal of polluted dredged material poses technical problems, and open water or wetland disposal sites are out of the question. Upland disposal sites would have to be found that are not directly or indirectly affected by surface or subsurface drainage patterns that would return toxic materials to the River or its tributaries.

At Cape Vincent, icebreaker movements that disturb the character of the adjacent ice cover will disrupt local ice fishing activity which constitutes a major winter recreation on the River in general and generates substantial revenue for permanent residents.

Aids to Navigation

Currently, the St. Lawrence Seaway Development Corporation is replacing existing aids with concrete structures but the number contemplated is unknown. Exact engineering information is not known at this time except that the structures that have been completed are 24 feet in diameter and at least one of them projects approximately 9 feet above the water surface. By way of comparison, a circle with a diameter of 24 feet would encompass about 452 square feet. Structures of this size and mass would destroy benthic habitat, flora, and fauna.

Ice Control Structures

The present system of ice booms, owned by the Power Authority, will have to be modified to permit vessel passage for Winter Navigation on the International section of the St. Lawrence River. The Galop Island Boom would be reconstructed and gapped. The Ogdensburg-Prescott Boom would be relocated, reconstructed, and gapped. Openings would be approximately 250 feet in width. An additional nine booms would be placed in the River between the Ogdensburg-Prescott bridge and Morrisburg, Ontario, to stabilize the ice cover in certain reaches of the River against vessel transit impacts, or to divert ice to ice storage areas. It is also proposed to install a 1,600 foot long boom at the entrance to Oswego Harbor in Lake Ontario. The type of anchor to be used for boom modification and additional boom construction is not finalized. If the "mud anchor," the type which now holds the present booms in place is used, loss of benthic communities and disturbance of bottom sediments is anticipated. Each mud anchor requires the dredging of a trench in the

riverbed. Approximately 350-400 square feet of bottom surface is permanently removed per anchor while an equivalent bottom area will be impacted by placing the dredged material adjacent to the excavation. Just to modify the existing two booms will require 4 to 6 anchors each. Assuming 6 anchors for each modified boom, approximately 9,000 square feet of bottom area will be disturbed by dredging activities, amounting to about 67,500 cubic feet of dredged materials which will be placed on the bottom for subsequent backfilling. The loss of benthic organisms in a 9,000 square foot area is not highly significant in terms of the dimensions of the river but of greater concern is the increased turbidity generated by the dredging operation. Additional benthic invertebrates and fish in the vicinity and surrounding areas could be adversely impacted. Also, the temporary placement of spoil on the bottom, even for a short time will subject it to the action of the swift river currents which could move large amounts to downstream areas where it could cover other benthic habitat. Anchor placement in polluted sediments will also release toxic materials potentially lethal to aquatic organisms.

By holding back ice the additional booms will have an effect on water levels. Frictional forces retard the flow of water under ice resulting in a backing-up effect upstream. The potential for damage to habitats and biota due to water level fluctuations above and below the ice booms is discussed in detail under Navigation Traffic.

Navigation Traffic

Vessel transits along the International Reach of the St. Lawrence River in winter will have significant, system-wide

impacts on both the biota of the River and their associated diverse habitats.

The winter ice cover on the St. Lawrence River is a complex entity which, when undisturbed by other than natural processes, is in delicate balance with the riverine system which it overlies.

In the channel proper, repeated vessel movement through the winter ice cover can create ridges of compacted ice at the edges of the vessel track. These ridges could be as much as 9 feet thick, 300 feet wide and extend for many miles along the upward bound and downward bound lanes. When this greatly thickened channel ice undergoes spring breakup and moves downstream, it has the potential for grounding upon, and moving across, shoals and low islands, gouging shallow bottom sediments and destroying benthic habitat and feeding, resting and nesting areas for fish, waterbirds, and waterfowl.

Breaking and maintaining an open vessel track through the ice and the formation of the ice ridges will also interdict the winter movement of mammals back and forth between the mainland and the many islands in the River. Winter tracking studies along a 20-mile stretch of the River indicate that at least 10 mammal species utilize the ice cover for winter movement. Foxes and coyotes were the most frequent users but cottontail rabbits and other small mammals (i.e., weasels, mice, moles, etc.) traveled substantial distances (over 300 feet) from shore.

Restricting cross channel movements and reducing island immigration and repopulation by mammals could have profound effects on ecological relationships in respective biotic communities. The more vulnerable insular prey populations would be decimated by avian predators and natural attrition, and there would be no stock available for replenishment of the island populations. This would result in decreased availability of food for the wintering migrant and breeding populations of raptors along the River as well as for those predatory mammals which take advantage of a stable ice cover to expand their winter feeding range to include offshore islands.

Reduced species diversity on the islands could lead to population imbalances and unchecked over-utilization of herbaceous resources by certain mammals leading to the destruction of island plant communities and cover.

Certain ice/shore interfaces exhibit an inherent fragility and are sensitive to the dynamics of vessel movement. Vessel induced wave surge interacting at the ice interface with shoals and islands can enlarge the natural cracks that occur at the interface. The pumping action of the surge would result in repeated wetting of the ice, increasing its thickness. Coupled with a lack of anchorage, the increased weight of ice would erode the edges of islands and shoals, scouring fragile benthic communities and disrupting detrital vegetative deposits, at the base of shoals, which serve as winter food stores for fish, benthic invertebrates, and periphyton.

There are at least 4,700 acres of valuable wetlands along the American side of the St. Lawrence River. These wetlands serve as spawning, nesting, feeding, and residence areas for a myraid of aquatic, semi-aquatic, and water-related species.

In winter, wetlands are normally separated form the thick bay ice by an ice foot, a deep, frozen ice layer often extending into the bottom at a wetland/bay interface. Characteristically, a tide or hinge crack occurs at this point and additional hinge cracks occur both bayward of this point and inward where shallow ice covers extend into a wetland.

At those wetlands where vessel passage-induced wave surge encounters the hinge crack, the result would be repeated flooding of the wetland snow and ice cover caused by bleeding of water through the hinge crack. Water taken up by the snow pack over the wetland would freeze down, forming dense snow ice layers in the vegetation and benthos at and below the substrate surface. This would result in the destruction of benthic organisms, the breakup of the emergent wetland vegetative mat in the spring, and the adverse alteration of an intricate system of under-snow cavities and tunnels which provide habitats essential to the survival of wintering mammals, reptiles, and amphibians.

The littoral zones of the St. Lawrence River are essentially limited to the areas of water surrounding islands and shoals and along shorelines that are less than 18 feet deep. These areas support, or have the potential to support, the major concentrations of rooted aquatic vegetation. To illustrate this point it is significant to note that only three sections

of the River, Chippewa Bay, the Brandy Brook area, and the proposed Demonstration Corridor, corresponding to approximately 35 linear miles of shoreline, contain 81 islands, 57 shoals, and 7,887 acres of littoral area. This linear distance represents only a little more than one-fourth of the total length of the International section of the St. Lawrence River. The western end, or Thousand Island section of the River, contains approximately 1,800 islands all fringed with littoral areas. Nearly 260 islands or island groups and 140 shoals are found along the entire length of the American side of the River. This translates into a conservative estimate of about 22,800 acres of productive littoral area for the American side alone.[1/]

Repeated vessel passage through the winter ice cover will focus strong wave surge forces at the interface of the ice cover with these shallow littoral areas, causing erosion, turbidity, and disruption of the ice cover as wave energy is dissipated. Blocks of ice, sediments, submergent vegetation, and fish can be, and are, sprayed onto the ice through cracks in the ice near the shoreline.

Ship passage impact on this littoral area will have a pronounced disturbing effect on a fragile and sensitive cycle of detrital transport and redistribution. Summer vegetation is represented by abundant growths of coontail, Canadian

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1/ This figure was estimated by making the calculation: 7887 (81 + 57) = 57, or the average number of acres of littoral area per island or shoal. Then 57 x (260 + 140) = 22,800 acres, an approximation of the number of acres of littoral area for the entire International Section. This figure must be on the conservative side as this calculation does not take into account the fact that there are approximately 3 times as many islands and shoals on the American side of the River that are outside the area from which the average of 57 was derived.

waterweed, water stargrass, star duckweed, water milfoil, and flat stem pondweed. Also, large quantities of macrophytic algae and stoneworts are present. In late fall and early winter, large mats of this vegetation are transported from nearshore areas by wind and currents to be deposited in windrows along substrate obstructions in deeper water and around shoals. These macrophyte deposits are extremely important as winter food sources for benthic populations and winter grazing areas for forage and game fish. Winter sampling of these deposits has shown that benthic invertebrates are 3.5 times more abundant and have 6 times more biomass than those from adjacent sediments.

The loose aggregation of weakly rooted and fragmented plants which remain in the shallow littoral areas represents stock for renewal of the rooted plant communities at spring breakup.

Vessel passage in close proximity to littoral edges will certainly disturb this fragile fabric of vegetative material and sediment. The full extent and significance of this disturbance is not known. But the potential for destruction of this extremely valuable resource base requires extensive evaluation before subjecting it to unnatural perturbations. These organic deposits represent an important seasonal resource for fish and may well constitute the major energy pool that sustains fish populations throughout the winter.

During even the most severe winter there are open water areas that occur in the ice cover due to upwelling currents generated by unusally deep water conditions or bottom irregularities in these areas. These pools are a seasonally

unique habitat complex extremely important to wintering birds including large numbers of migratory waterfowl that utilize the River in winter. Hunter census data for 1973 shows that 4,378 hunters harvested 3,816 waterfowl along the River and in surrounding areas.

At least 50 percent of the most abundant wintering species preferentially utilize these habitats. Surveys have documented that 21 waterbird species frequent these pools including substantial numbers of Canada geese, mallards, black ducks, common goldeneyes, common mergansers, great black-backed gulls, and herring gulls. Because of the waterbird concentrations at the pools, several species of raptors, including rough-legged hawks, red-tailed hawks, and the Federally endangered bald eagle utilize these areas on an occasional to regular basis. The bald eagle, in particular, regularly frequents the pools, feeding on fish and waterfowl.

Ship movements in proximity to, or through these unique winter habitats, could destroy their open water integrity by creating brash ice which would tend to fill in the pools. Many of the waterfowl congregate in the calm, disturbance-free nearshore and ice-edge areas of a pool where the diving ducks can feed effectively in the shallower water. Creation of a deep open water ship channel at the expense of the pools may be substituting a linear amount of low-quality, disturbance-prone habitat for natural high quality habitat. The destruction of these pools may thus eliminate crucial winter feeding and resting areas for wintering birds, causing them to venture elsewhere to compete with other wintering birds for food that is already in limited quantity because of seasonal conditions.

The dispersal of wintering waterbirds away from the River would deprive the wintering bald eagles of a dependable food source and could possibly alter the distribution of this bird in New York State. Recent surveys along the River have recorded 49 sightings involving at least 7 and possibly as many as 14 birds. This concentration represents one of the two known wintering concentrations in New York State. The St. Lawrence River area is of particular importance because at this time it is relatively free from human disturbance thus providing the best wintering refuge for this species within New York State and surrounding areas.

In the Galop Island-Prison Island area, in the vicinity of a large open water pool, there were 13 winter sightings representing an adult male and a sub-adult female who remained in that area throughout the 1977-78 winter season.

Water Level Impacts

In addition to water level alterations caused by ice boom operation, icebreaking activities and repeated vessel passage through the ice cover can also influence water levels by causing substantial volumes of ice to "bleed" through the navigation openings installed in the ice booms at Ogdensburg-Prescott and Galop Island. Modeling studies predict approximately 700,000 cubic feet of ice could be released through a 300-foot wide gap in an ice boom by a single ship passage. Project plans call for 250 foot wide openings in the booms which would release a lesser but still highly significant amount of ice, perhaps in the range of a half million cubic yards. This ice could then progress down river until encountering natural jamming points where it would contribute

to the formation of hanging dams which retard river flow causing upstream water level increases of up to perhaps one foot or more as far back as, and on into, Lake Ontario, depending upon the number of daily ship passages. This would have disastrous consequences for thousands of acres of wetlands, shallow littoral areas, shoals, and islands and mainland shoreline.

Downstream of an ice jam, reduced head loss would result in loss of power production at the Moses-Saunders Power Dam at Massena, New York. To compensate for this, the Power Authority anticipates having to provide additional head by drawing down Lake St. Lawrence. This will cause the winter ice cover to collapse on fragile wetlands and littoral areas downstream of the ice jams, dewatering and crushing benthic and aquatic plant communities. Spring breakup will result in these areas being scoured and gouged by ice movement.

Around shoals and islands pressure wave surge generated by vessel passage could pump the additional water volumes through the crack at the ice-island or ice-shoal interface, contributing to the wetting of the ice surface and changing it into one with a greater snow ice concentration. The combination of increased snow depth and lack of anchorage to the shoal or island will increase the potential for ice erosion of the shoal or island edge. Scouring caused by the movement of the greatly thickened ice mass will damage fragile benthic and detrital communities around the shoals and islands. Large chunks of ice pushed further shoreward onto islands will disrupt low-lying island vegetation and gravel areas which are often used by colonial waterbirds for breeding areas. Spring melt down of these chunks will

contribute to the erosion of the island edge and carry silt into adjacent submerged littoral areas which would smother emerging macrophytes and benthic invertebrates.

The shoals and small islands of the St. Lawrence River constitute an extremely vital habitat for birds. They provide breeding habitat for a number of species, in particular colonial waterbirds. The locally declining herring gull and the Audubon blue-listed common tern nest exclusively in such areas. Other terns, gulls,and various shorebirds and waterfowl utilize these areas for feeding, nesting, and loafing at various times.

There are a limited number of small low islands, having little elevation above river level, which are vegetated with grasses and other herbaceous plants. This vegetation is the key to the usability of these islands by nesting birds. The low-lying islands are often in unprotected areas and are susceptible to changes in the physical environment. Those species which nest on shoals and islands are restricted to this type of habitat. Winter water level elevations which inundate these areas, or facilitate ice movement and scouring across these areas, would lead to the destruction of the already limited number of nesting sites required by the colonial waterbirds inhabiting the River. Breeding waterfowl also utilize these islands and mallards and gadwalls are the two most common nesting waterfowl on the River, often utilizing the same islands, with mallards nesting first and gadwalls later.

The very real potential for flooding approximately 4,700 acres of wetland along the American side of the St. Lawrence

River, as well as at least 6,500 acres of Lake Ontario wetlands in Jefferson and Oswego Counties alone, is of overriding concern. Water levels are the single most important factor that determines species composition and productivity in emergent wetland communities. Because topographical relief in wetlands is generally very flat, small changes in water level elevation can inundate large areas of wetland, eliminating or reducing perennial aquatic vegetation.

Water level increase during winter, regardless of cause, can flood wetland snow and ice covers by the bleeding of water through a characteristic hinge crack which occurs at the wetland/bay interface. This would significantly alter the character of the wetland ice and snow pack. Water taken up by the snow pack to form slush layers at the substrate surface would freeze down to form dense snow ice layers in the vegetation and benthic communities at the bottom surface.

The natural winter wetland condition will be significantly altered by the freezing and destruction of surface benthic organisms, by the creation of additional cracks and ice instabilities which will result in the breakup of the emergent wetland mat during the spring, and by altering a unique and intricate pattern of under-snow cavities and tunnels which provide crucial habitat for overwintering mammals, reptiles, and amphibians.

Simultaneously, wetting of the ice surface along the hinge crack increases the snow ice depth, and extends the area of freeze-down further out into the bay. This effect will serve to magnify a process of natural disturbance which normally occurs at the wetland/bay interface at spring breakup.

Flooding of wetland vegetation generally reduces productivity and causes eventual vegetative die-off if flooding is of extended duration and sufficient depth. Water depth tolerance varies with the species of plant but cattail (*Typha spp.*), a dominant wetland plant in St. Lawrence River and Lake Ontario wetlands, is very sensitive to water depth. A water level increase exceeding or even approaching one foot could greatly reduce cattail abundance.

A recent survey of Campbell Marsh, a 75-acre wetland adjoining Henderson Bay on Lake Ontario, Jefferson County, New York, showed that cattail (*Typha glauca*) was the dominant wetland plant at a water depth of about 14.5 inches. At the 19-inch water depth gradient cattail abundance was reduced by 50 percent and at the 22-inch water gradient cattail was absent. Thus, the relative abundance of cattail went from dominance to absence with an increase in water depth of only 7.5 inches. Therefore, a prolonged, project-related water level increase amounting to only 8 inches over prevailing water levels could eliminate extensive areas of productive cattail marsh.

The cattail-dominant marshes along the St. Lawrence River are extremely important to various aquatic, avian, and terrestrial fauna of the region. Excessive winter flooding and freeze-down will have a devastating effect on reptiles and amphibians. The winter months are the crucial period of hibernation for turtles and amphibians who seek the mud bottoms of marshes. Freeze-down in the substrate and scouring of the substrate by spring ice movements will destroy this vital habitat along with those herptiles that are hibernating within it.

The wetland communities and their associated habitats are extremely important to the maintenance of the herptile populations of the St. Lawrence River. They provide the required habitat for reproduction of most amphibians, and are probably the hibernation site for frogs and turtles. Any impacts that will disturb the wetland/bay interface will impact herptiles which consequently will decrease the availability of a major food source for fish, mammals, and birds, in particular, the wading birds such as great blue herons which have a major rookery on Ironsides Island.

Water level fluctuations which destroy or reduce emergent vegetation will deprive many marsh and water-edge birds, and waterfowl of nesting habitat, cover, and native food plants. The St. Lawrence River presently supports the only reasonably healthy population of marsh hawks (or northern harriers) in New York State, including perhaps as many as 15 breeding pairs that depend upon the availability of marsh habitat for nesting sites.

Point Marquerite Marsh at the southern end of Goose Bay is one of only two active black tern nesting sites on the St. Lawrence River. This species, which requires cattail habitat and may nest any place within the marsh, is declining in numbers along the River and breeding activity is very sensitive to water level changes. Any circumstances which would result in the flooding and subsequent destruction of their preferred nesting habitat could eliminate this species from the St. Lawrence River.

The muskrat is the one mammal most likely to be affected by water level fluctuations in the cattail-dominated wetlands

along the St. Lawrence River and Lake Ontario, in particular the eastern end. Muskrats forage heavily upon the nutritionally superior cattails in the wetland areas. Water level induced loss of the wetlands would not only decrease food availability for the muskrat, as well as for other riverine mammals, but would also eliminate lodging and breeding areas. The large populations of muskrats along the River support an important seasonal trapping industry. Recent records show that, for a 3-year period (1974-77), 16,426 muskrat pelts were purchased from trappers in a regional area encompassing only about 20 linear miles of the River. This represented 85 percent of all the furbearing mammals trapped. At a current price of over $5.00 for a prime muskrat pelt, this represents, dollarwise and riverwide, a six to seven figure annual income to a region which is, in general, economically lean.

Wetlands, and associated shallow littoral areas discussed further on, represent major sources of organic matter input to the St. Lawrence River. Vegetative material entering the system in the form of detritus supports the metabolic activity of most aquatic invertebrates. Disruption of this source of organic carbon would have repercussions throughout the entire aquatic food chain.

Water level alterations which impact wetlands will have serious implications for the fisheries of the St. Lawrence River. The River supports an extremely important year-round recreational fishery which generates substantial revenue for the regional economy. Ice fishing may comprise as much as 98 percent of the winter use of the River.

Nearly all the marshes along the St. Lawrence River, whether along the main shoreline or around island shorelines, are potential spawning areas for northern pike which are highly prized by both summer and winter anglers. If winter navigation activities contribute to lowered water levels critical northern pike spawning areas may be lost. If the ice cover in or over pike spawning grounds is modified in a manner that would impede spawning runs, future recruitment may be reduced.

Water level fluctuations may have indirect consequences for fish as a result of changes in the extent or composition of shallow water communities. Wetlands are particularly valuable as feeding, resting, spawning, and nursery areas for many important fish species. Water level fluctuations which significantly disrupt shallow bay and wetland plant communities and substrate structure may have significant impact on the fisheries of the river.

Water level fluctuations resulting from ice jams or wave surge may exert significant effects on the shallow littoral areas. Constant wave surge, or water level rise could result in substantial disruption of the ice foot at the wetland front. Under natural conditions a zone of disturbance forms at the ice foot where ice frozen to the substrate is lifted by buoyant snow ice layers prior to the occurrence of bottom melting. This zone is narrow under natural conditions and in relation to normal increases in spring water level. However, if unusually high water levels were to occur in spring, this zone would expand, resulting in major disruption

of the bottom features at this interface. Decreased water levels, below ice jams or resulting from power pool drawdown, would result in additional freeze-down at the ice foot. If water were drained completely from the ice/benthic interface as occurred at Brandy Brook in 1978, substantial die-off of benthic organisms could occur. Brandy Brook, just opposite Morrisburg, Ontario, experienced a drawdown exceeding 8 feet during the winter of 1978. Consequently, the ice canopy froze to the bottom and successive water level increases resulted in freeze-down extending further outward toward the channel.

The formation of new hinge cracks and collapsing and tilting of the ice cover causes sediments to become deeply frozen and disrupted. When spring melt occurs the bottom ice remains frozen to the substrate and when it does refloat it tears rooted vegetation and benthos from the bottom along with large amounts of entrained sediments which will be dropped on downstream areas.

Dredging

The amount of dredging proposed for velocity control along the River varies from 54.5 million cubic yards to 84.4 million cubic yards depending upon whether final projected flow velocities are to be 2.25 or 2.0 feet per second (fps). Other related dredging for a deeper and wider shipping channel, associated with the proposed construction of additional locks, amounts to about 29.9 million cubic yards of material. In actuality, an accumulative total ranging from about 84.4 to 114.3 million cubic yards of dredging is proposed for the St. Lawrence River. Furthermore, this total only accounts for initial construction dredging. These figures do not reflect an unquantified amount of

maintenance dredging that will be necessary over the life of the project. Dredging activity of this magnitude will destroy benthic fauna and habitat over a bottom area of approximately 2,668 to 3,447 acres. Reestablishment of benthic communities will take months or even years, or may not occur at all if bottom characteristics are drastically altered. This could have long-term impacts on higher trophic levels. Dredging associated with construction of the original Seaway Project in the 1950's effectively eliminated the walleye and sturgeon fisheries from the river.

Massive dredging operations such as this will generate suspended sediments which will contribute to siltation of an undetermined amount of submerged acreage beyond the actual area of impact. Large amounts of silt transported to shallow areas will cover and smother benthic invertebrates and rooted aquatic plants and their attached periphyton. Excessive turbidity reduces penetration of sunlight and, consequently, reduces photosynthesis and the level of respirative oxygen production by submerged vegetation. Suspended silt can clog the gills of fishes and interfere with respiration. Normally, most free swimming forms would avoid restricted dredging areas when the threshold of discomfort was detected; however, dredging as proposed for the St. Lawrence River involves large areas and would take long periods of time to complete.

Recent fish surveys along the River have provided evidence for the existence of distinct subpopulations of northern pike, yellow perch, smallmouth bass and brown bullheads, with indications that geographical movement of individuals is not extensive. If this is the case, localized negative impacts may be severe for these species. They may not be

genetically programmed to range very far and may not leave a large area under the influence of dredging-induced impacts. If they do leave, they will compete for food and space with fish populations in nonperturbed areas with a resultant decrease in populations.

Dredging of sediments always carries with it the potential for release of sorbed organic and inorganic contaminants back in the aquatic environment. Factors such as sediment particle size, texture, interstitial water content and solubility of the contaminant influence the degree and rate of release of contaminants. Nevertheless, various aquatic biota such as rooted vegetation, molluscs, and detritivores are probable vehicles for assimilating and introducing contaminants into the food chain. The long range effects can be serious as we are acutely aware from our knowledge of the effects of pesticides on reproductive mechanisms in birds. For example, egg shell fragility caused by DDT contamination has brought the peregrine falcon to the brink of extinction.

Disposal of vast amounts of dredged materials also poses serious environmental problems. Open water disposal anywhere along the River is unacceptable. Upland disposal of spoil will result in destruction of higher seral stages of nonwetland vegetation serving as habitat for numerous mammals, birds, and reptiles. Destruction of subterranean animal species can occur while others will be displaced to areas that may already be at carrying capacity. Dredge disposal sites have not been determined definitely but vast areas will be required. The dredging volume in the vicinity of Ogden Island alone is 34.5 million cubic yards. If this were placed on the island itself it would cover 303.8 of

the island's 410 acres, or about 74 percent of the available surface to a height of 23.5 feet above existing elevation.

If spoil materials are not properly contained and protected, contaminants may leach back into the aquatic environment, while erosion may carry large amounts of raw spoil back into the River, lakes, or adjacent watercourses.

Oil and Hazardous Substances

Extension of winter navigation on the St. Lawrence River and Lake Ontario increases the potential for adverse environmental impacts due to the spillage of oil and other toxic substances. This can occur as the result of vessels running aground, colliding with other vessels, solid objects or ice, or from the operation of vessels that are not adequately prepared for the hazards of winter navigation. The majority of polluting incidents result from structural failures, some of which arise from damage sustained by navigating under adverse weather conditions.

A major oil spill on the St. Lawrence River could be disastrous for the aquatic environment. Oil spills in the best weather conditions are often difficult and costly to contain and clean up as evidenced by the NEPCO 140 spill, involving 300,000 gallons of No. 6 oil, which occurred on the St. Lawrence River on June 23, 1976. Containment and cleanup measures were vigorously applied, yet it cost in the neighborhood of 8.5 million dollars, only about 10 percent of the spill was recovered, and virtually all aquatic areas bounding the American side of the River were affected by the oil.

Even though booms were deployed around the barge within hours after grounding they were ineffective due to the prevailing current conditions. Responding to current velocities ranging from 2 to 7 knots and aided by westerly winds, oil spread rapidly down the length of the River in 4 days time, contaminating the intricate network of inlets, bays, and islands. Alexandria Bay, New York, an intensely developed recreation area in the heart of the Thousand Islands region was included in the area of contamination. Including islands, bays, marshes, and coves, it is estimated that more than 350 miles of shoreline were subjected to the effects of the spill. This incident occurred near midsummer under weather conditions which are probably ideal for the region at that time of year. A similar occurrence in winter would magnify the adverse impacts immensely. During an extended navigation season on the River, there will be a variety of ice conditions encountered by vessels ranging from a solid ice sheet to open water areas containing slush. Often there will be fields of moving, broken ice chunks. An oil spill under these conditions would be virtually impossible to clean up.

The Coast Guard has tested containment booms in cold regions and has concluded that no currently available boom is capable of containing oil spilled within a moving, broken ice field containing substantial-sized pieces of ice. Broad systems capable of recovering oil spilled on, over, or sandwiched within ice, oil mixed with broken ice, or oil frozen within broken ice masses do not exist at present.

This point was graphically illustrated when, on February 20, 1979, a fractured pump housing released approximately

165,000 gallons of highly toxic #2 fuel oil from an onshore storage facility at Ogdensburg, New York, on the St. Lawrence River. About 145,000 gallons were recovered from a diked containment area, yet a significant but unknown amount of oil, in the range of 7,000 to 11,000 gallons, entered the River beneath the ice cover. Compounding the problem was the fact that oil was reportedly not observed in the River until March 5, nearly two weeks later, pointing out the fact that oil spilled under an ice cover may spread out and travel great distances and/or impact sensitive aquatic areas for long periods of time prior to being discovered.

Although the clean up operations were initiated, a belated response time, weather conditions, lack of oil removal technology under ice conditions, and lack of a contingency plan for winter spills precluded rapid and efficient recovery of oil from the river. An unknown amount of oil may have moved down the St. Lawrence River unnoticed beneath the ice cover as a result of this spill and the environmental cost is still to be determined.

The majority of post-spill biological observations have been made in saline environments, i.e., open ocean or estuarine areas. However, a limited number of freshwater wetland studies have shown that upon contact crude oil causes an immediate reduction in the chlorophyll content of macrophytes and significant decreases in biomass over ensuing growing seasons. Annual species may be the most severely affected during the season following a spill. Oil pollution in winter may appear to have little effect on overwintering dormants; however, winter oiling may significantly reduce seed germination.

No massive mortality of zooplankton has been observed following a marine oil spill but laboratory observations indicate that zooplankton are sensitive to oil. One hundred ppm of oil causes mortality within 24 hours to all zooplankton tested. At 1 ppm the adults of many species survive but the larvae die in three to four days. Oil frequently breaks up into globules in the micron to millimeter size range which corresponds to the size of food particles utilized by many zooplanters, thus enabling them to ingest oil. This oil may be passed on to higher trophic organisms that feed on zooplankton or it may be excreted back to the environment to be fed upon by benthic detritavores.

Oil, of course, is not the only lethal substance that could be spilled. Refined fuels, other liquid chemicals, and soluble dry chemicals are all potential cargoes. Diesel fuel, for example, kills organisms on contact and a recorded spill in a freshwater stream in California killed crayfish, water boatmen, water spiders, adult and larval diving beetles, mayfly nymphs, dragonfly nymphs, damselfly nymphs, leeches, and planarians. Over 2,500 fish were killed by this spill.

Oil is toxic to fish but no large scale fish kills have been recorded near marine oil spills. This may be due to their ability to swim out of contaminated areas. The larval and juvenile forms appear to be more adversely affected by oil than adult forms. Selective elimination of immature forms could affect future population dynamics and community structure.

Oil pollution presents serious hazards for aquatic and semi-aquatic mammals. Their closely packed fur not only provides

insulation, but it also traps oil. Along the St. Lawrence River this has lethal implicationsfor the muskrat population and the viable trapping industry they support. The fur of oiled muskrats can lose its thermal insulative properties which in turn increases thermal conductivity. In order to compensate for energy lost as dissipated heat, muskrats may increase their food dry matter intake as much as 250 percent, placing a strain on limited winter food supplies. Because of their dependence on an aqautic environment, both for feeding and as a place of refuge, muskrats exposed to even moderate quantities of oil may not survive under natural conditions.

The most vulernable and visible victims of oil spills are birds. The deaths of large numbers of birds, on the order of thousands, following oil spills is well documented. Oil matting on the feathers causes loss of insulating properties, and this results in loss of body heat and mobility. Death may result from drowning, starvation or exposure, i.e,, inability to maintain body temperature, thus feather oiling becomes more of a problem in cold water areas. Birds can ingest oil by feather preening, feeding, or drinking. This leads to a host of physiological pathologies of the liver, intestinal tract, kidney, adrenal glands and fatty tissue, which are lethal to the bird. Mammalian or avian scavengers, such as bald eagles that feed on the dead or moribund birds are themselves susceptible to chronic debilitation from ingesting sublethal quantities of the toxic substances, which may lead to reproductive failure or death.

The birds most frequently affected by oil spills in northern waters include loons, grebes, mergansers, eiders, oldsquaw, scaups, goldeneyes, pelicans, gannets, cormorants, herons,

gulls, terns, and shorebirds. Birds such as loons, grebes, cormorants, and waterfowl that spend part of their time on the water surface are the most vulnerable. The wintering waterfowl population on the St. Lawrence is primarily common goldeneye and common merganser although other species in lesser numbers can be found at any given time feeding and loafing in open water areas along the shoreline or at the ice edge. A winter oil spill on the St. Lawrence River would, without a doubt, seriously impact wintering water bird populations.

A winter oil spill on the St. Lawrence River may affect the entire biotic community of the system. Ecosystem recovery rates from oil spills under temperate conditions that permit aggressive countermeasures are still measured in terms of one or two years or more. Recovery may never be totally complete. Oil that sinks to the bottom can penetrate bottom sediments where it sits for years chronically leaking toxic soluble fractions back into the water column and poisoning the substrate so that benthic organisms and rooted macrophytes cannot recolonize an oiled area. In shallow waters, oil has penetrated as much as 2 feet into marsh sediments.

An oil spill under the ice, or under climatic conditions that preclude effective containment and cleanup, compounds the problem enormously. On the St. Lawrence River, where currents are swift, oil can be carried to areas far beyond the shipping lane to lie under or within the ice for months until ice breakup when it would be released into wetlands, marshes, shallow littoral areas, and onto islands and shoals through the effect of water level rise and ice movement dynamics. Entire populations may be uniformly affected. Elimination of species may lead to a decrease in species

diversity and subsequent community simplification. Increased mortality of juvenile forms may lead to subtle, but far-reaching effects on population dynamics, community structure, and ecosystem stability.

Thermal Additions

The addition of waste heat to the St. Lawrence River to inhibit or eliminate ice formation in certain areas is under serious consideration. It has been calculated that waste heat from conventional-sized power plants that utilize once-through cooling could be discharged to the River to balance winter heat loss at the surface. This concept would present serious problems for the aquatic environment on a year-round basis, not just in the winter.

Basically, power plants, whatever their fuel source, require a large supply of water for collecting and removing waste heat derived from power generation. To accomplish this a typical plant that employs once-through cooling requires an intake structure located in the water body, a piping system that circulates through the generating module, and an outfall structure to return the heated water to the system from which it was derived.

Three such plants have been proposed for the International Section of the River, at Chimney Point, Iroquois, and Massena Point. The minimum generating capacity would be 1,000 megawatts. The water requirement for the smallest plant would be about one billion gallons per day which represents only about 0.03-0.04 percent of the daily input from Lake Ontario. However, the placement of the plants is such that a relatively large proportion of the water between the upper and lower

plants could be reutilized in the long run. A given volume of water could be turned over and heated three times.

Due to the swift current velocities in the St. Lawrence River, it is well mixed and does not thermally stratify sc it would appear that cooling water effluent temperature may be buffered and diluted by the River in winter when the prevailing water temperature is normaly less than 34^{o}F. The major thermal impacts on aquatic organisms presented by power plants occur in seasons when waste heat exceeds the mean water temperature, which approaches the low 70's (^{o}F) in the St. Lawrence River. Coincidental with termal impacts are physical impacts associated with cooling water withdrawal, i.e., entrainment, impingement, and entrapment of aquatic organisms, and the chemical effects of biocides and chemicals used to rid cooling systems of slime or scale buildup.

The initial impact of a power plant on the aquatic environment is the immense volume of water that must be continuously withdrawn from the aquatic system to satisfy cooling requirements. It is only within the past decade that there has emerged a real awareness of the magnitude of the impact of intake structures and water use on aquatic organisms residing in the affected water body. There now exists extensive documentation of direct impacts on fish and planktonic communities, but more information is needed about the long-term effect of these losses on population continuity and species diversity.

Entrainment is the carrying of organisms into the intake structure, through the cooling system, and to the discharge

structure. Even though all conventional intake structures depend on screens to minimize entry of aquatic organisms they do not prevent the entry of plankton, egg, and larval fish. Entrainment mortality usually is close to one hundred percent, and is the collective result of mechanical damage, shear forces, pressure changes, and biocides encountered in the cooling system.

Impingement describes the condition in which larger organisms, caught by the inflowing current, are held against the screens or trash racks at the intake entrance. Impingement mortalities of over a million juvenile fish per day have sometimes been recorded at some power plant intakes.

In winter the plume of heated water discharge from a power plant creates a zone of warmer water that often attracts fish. The degree of attraction varies with species because of differences in preferred temperatures, but nevertheless, this congregation of fish can subject them to adverse impacts. Fish are particularly sensitive to abrupt water temperature changes, especially rapid decreases in temperature. Fish residing in thermal plumes become acclimated to an artificial temperature regime and may not be able to adapt rapidly enough to cold temperatures. Large fish kills have been documented in the plume areas of power plants that have experienced winter shutdowns for one reason or another. Aquatic plants and benthic organisms are also sensitive to rapid changes in termperatures.

Exposure to elevated temperatures stimulates increased metabolic energy demand in fish. Unless there is a simultaneous stimulation of food sources fish populations residing in thermal plumes may experience serious problems.

It has been documented that some fish species living in artificially warmed water exhibit lower coefficients of condition than their counterparts living under natural conditions. Lower condition factors, or "skinniness" suggest a state of chronic malnutrition. This could have a negative effect on reproduction since the female, in particular, must divert a significant amount of stored energy reserves for egg formation.

Thermal plumes may distract certain species from their normal spawning run. Reproductive activity is influenced to a great extent by light cycles and temperature rise. Migrating fish that encounter a thermal plume may stop there and terminate spawning activity if there is not suitable spawning habitat within the sphere of influence of the plume.

Thermal plumes can alter species distribution of phytoplankton populations. Heated water has been known to enhance plankton blooms and to shift floral communities from diatom-dominated to blue-green algae dominated. Blue-green algae are indicative of deteriorating water quality. Community composition and diversity among rooted aquatic macrophytes and benthic invertebrates is generally decreased when they are exposed to sustained elevated water temperatures.

Power plants frequently discharge slugs of biocides, primarily chlorine, into the area of the thermal plume. Fish are sensitive to even slight amounts of lethal substances and will rapidly exhibit avoidance behavior. If driven from the warmer water, they may experience temperature shock as described above. If they stay in the plume, they are subject ot the lethal effects of the toxic substance. Chlorine toxicity to aquatic organisms is well documented.

Other species may be indirectly affected by the system-wide influence of a thermal plume. The creation of large areas of relatively warmer open water may, for example, attract and hold waterfowl that normally would be migrating to more temperate climates. This could place an additional strain on the already limited winter food and space resources of the area. Crowding and chronic malnutrition promotes debilitation of a population by increasing their susceptibility to starvation and disease. In total, this could significantly alter flyway patterns and species distributions.

D. Discussion

We conclude that to build this project as currently planned would irretrievably impact, in an adverse way, the St. Lawrence River ecosystem. Dredging of at least 84 million cubic yards of material, to widen and deepen the channel and reduce current velocity, would directly destroy from 2,668 to 3,447 acres of river bottom habitat. Placement of the mountains of spoil that would emanate from dredging would destroy untold acreages of other kinds of habitat types depending on where it would be placed. To illustrate, placement of spoil on Ogden Island, the only designated site so far, would increase the height of seventy-four percent of that 410 acre island by as much as 23.5 feet. The potential and immediate detrimental effects of this are obvious.

Water level changes which might be created by hanging ice dams resulting from ice bleeding through the navigation openings in the ice booms would severely degrade the quality of at least 4,700 acres of St. Lawrence wetlands including important cattail marshes. This would mean a significant reduction in the nesting population of marsh hawks along the St. Lawrence River, the loss

of the only black tern nesting site along the International section of the River, and a significant reduction in the muskrat population along the River. A water level rise on the River would be translated back to Lake Ontario and would affect at least 6,500 acres of additional wetland along the Lake front of Jefferson and Oswego Counties alone.

Surge waves generated under the ice by ship passage would enlarge the ice foot along the shoreline of mainland, islands, and shoals and adversely affect at least 26,500 acres of littoral zone vegetation and wetlands. These areas are essential to the maintenance of the aquatic food web and also provide areas of hibernation for small mammals and herptiles.

The closing of open water areas with brash ice would deny important wintering habitat to waterfowl and bald eagles. We can only assume these populations would be greatly reduced, if not eliminated.

These are only some of the effects of this project that are somewhat measurable. There would be many other impacts which we have been unable to measure. Undoubtedly, there would be significant adverse impact on the multi-million dollar recreation industry. The human inhabitants are closely linked to, and dependent upon, a healthy ecosystem. A severe reduction in the resource base upon which the recreation industry depends would not only mean a reduction in the quality of life but an impairment of the ability of the inhabitants to earn a livelihood in the counties bordering the St. Lawrence River.

We can see no feasible way of adequately mitigating the losses that would result from implementation of this proejct as currently designed on the St. Lawrence. The dredged channel bottom areas

might recover over a long period of time, but some maintenance dredging activity would be continually necessary which would periodically redisturb parts of the river bottom, perpetuating its unproductiveness. Likewise, the impacts form an enlarged ice foot and increased flooding of the snow-ice cover at the edges of wetlands cannot be mitigated. Littoral vegetation would undergo a change in successional composition, and the value of the habitat would be significantly reduced. It is this diminishment in the quality of the food chain base that cannot be mitigated. Also, the wetlands lost as a result of any water level changes could not be replaced short of creating other wetlands elsewhere. This in itself would result in losses of other kinds of of habitats that would need to be mitigated. To be sure, the open water areas in the ice could probably be recreated elsewhere in the river by the installation of bubblers or by some other means. However, we would have no assurance that this would create conditions similar enough to the existing situation to prevent the loss of waterfowl and bald eagles.

We, therefore, conclude that the project as currently proposed would not be in the public interest with respect to fish and wildlife, related environmental resources, and the human uses thereof.

E. Recommendation

We recommend that the Winter Navigation Season Extension Project for the St. Lawrence River, as currently proposed, not be authorized for construction and operation.

XIII. State Comments on Draft Fish and Wildlife Coordination Act Report of January 1979

The natural resource agencies of the States of New York, Pennsylvania, and Wisconsin provided formal review of the January 1979 draft of this document. Comments from these State natural resource agencies have been incorporated, as appropriate, in this Final Report. Copies of the State letters follow this page.

588

New York State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

Robert F. Flacke
Commissioner

APR ... FISH & WILDLIFE SERVICE TWIN CITIES, MN

March 26, 1979

Mr. Charles A. Hughlett
Acting Regional Director
U.S. Dept. of the Interior
Fish and Wildlife Service
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

Dear Mr. Hughlett:

Thank you for the opportunity to review and comment on your Draft Fish and Wildlife Coordination Act Report on the Corps of Engineers' Plan for the Great Lakes - St. Lawrence Seaway Navigation Season Extension. As you know, we are greatly concerned about this project and its potential impacts. To emphasize this concern, we have limited our comments to those we consider of major importance. We have not included a number of items of a more technical nature, which are of secondary significance to us. Our conclusion is that we can only partially concur with the report as follows:

1. We fully concur and support the recommendation that extended navigation on the St. Lawrence River not be authorized due to significant adverse environmental consequences. This is consistent with previously expressed positions of this Division, the Department of Environmental Conservation and the State of New York with regard to both adverse environmental and economic consequences.

2. We take strong exception to acceptance of phased implementation or a programmatic approach under a single-phase construction authorization. We have consistently maintained that determination of environmental feasibility must precede any authorization for construction, operational or demonstration programs associated with winter navigation. We cannot concur with your report unless it supports this approach as provided for under a two-phase congressional authorization. We believe two-phase authorization should be requisite for all projects of undetermined environmental feasibility.

Mr. Charles A. Hughlett
Page 2
March 26, 1979

3. The report does not address the need for an institutional arrangement that will insure well-coordinated federal agency, state and sub-basin representation and participation in program implementation. This has been a serious deficiency to date and must be corrected.

4. The report does not address the need for a balanced voting representation on the Winter Navigation Board (or its successor) and its working committees. This is essential to encompass the broad range of interests affected by the program. The failure to allow individual states a vote is a denial of their basic rights to shape policy directly affecting them.

We will gladly discuss these comments in more detail if you desire.

Sincerely,

Kenneth F. Wich
Acting Director
Division of Fish and Wildlife

COMMONWEALTH OF PENNSYLVANIA

DEPARTMENT OF ENVIRONMENTAL RESOURCES
P. O. BOX 1467
HARRISBURG, PENNSYLVANIA 17120

The Secretary

590

In reply refer to
RM-R
GO:561.1
Your Ref. LWR

March 2, 1979

RECEIVED MAR - 5 1979 FISH & WILDLIFE SERVICE TWIN CITIES, MN

Charles A. Hughlett, Acting
Regional Director
U.S. Department of the Interior
Fish and Wildlife Service
Federal Building, Fort Snelling
Twin Cities, Minnesota 55111

RE: Your letter of January 19, 1979

Dear Mr. Hughlett:

The Department of Environmental Resources continues to be in favor of consideration of a pilot demonstration project to study and monitor the effects of extending the Great Lakes winter navigation season, as long as it is conducted in an environmentally safe manner.

Operating vessels in ice obviously increases the possibility of an accident which could result in an oil spill. In the event of a spill, an additional problem arises -- that of containment and cleanup. A 1977 study of oil spill abatement in cold regions reports that there is no presently available device unusually capable of recovering oil spilled on, or sandwiched within ice, under all ice conditions.

The U.S. Coast Guard has developed operating and design criteria for vessels operating in ice and transporting oil and hazardous substances. Presently, these criteria are recommended to but not required by operators. These criteria should either be required or certain incentives should be developed to insure that winter operated vessels provide maximum protection against oil spills.

We feel that consideration of a demonstration program should be pursued as long as proper safety for the environment and life are provided.

Sincerely,

Clifford L. Jones

CLIFFORD L. JONES

State of Wisconsin \ DEPARTMENT OF NATURAL RESOURCES

15 MAR 79

Anthony S. Earl
Secretary

March 15, 1979

BOX 7921
MADISON, WISCONSIN 53707

IN REPLY REFER TO: 1600

MAR 1 9 1979
FISH & WILDLIFE SERVICE
TWIN CITIES, MN

Mr. Charles Hughlett
Acting Regional Director
Fish and Wildlife Service
Federal Building, Fort Snelling
Twin Cities, MN 55111

Dear Mr. Hughlett:

Re: Draft Fish and Wildlife Report to Accompany the Corps of Engineers Survey Report, Great Lakes-St. Lawrence Seaway Navigation Season Extension

The Department has completed its review of the above document and offers the following comments:

Specific Comments

Page 30, Ice Breaker Mooring Facility - Which harbors will require dredging and construction of mooring facilities? A description of the size and scope of these proposals should be included.

Page 32, Air Bubbler System - Since it is unknown if bubblers will keep the area above them open once the ice is broken, will additional studies be performed to determine if this is possible?

Page 34 - This section does not specifically mention open water dredge spoil disposal. However, we will take this opportunity to point out that the laws of the State of Wisconsin do not allow for the open water disposal of dredge material within any of the bodies of water under our jurisdiction including Lakes Michigan and Superior.

Page 38, Vessel Speed Control and Enforcement - What are the anticipated vessel passage impacts on the harbor?

Page 38, Vessel Operation and Design Criteria - Would additional regulations and enforcement requiring ships to meet the explicit design criteria for operating in ice be outside of this plan? Please explain why.

Page 45, Icebreaking Requirements - Because the open areas attract water birds, they would be susceptible to any oil spills occurring in these waters.

Page 47 - The attraction of wildlife and fish to areas where the bubblers are operating may increase their susceptibility to harm if an oil spill should occur.

Page 49, Oil/Hazardous Substance Contingency - Apparently a good working oil/hazardous waste containment plan is unavailable. This plan is an essential part of any winter navigation proposal.

Page 50, E - Discussion - What institutions or firms have been contacted for the data collection?

Page 51, paragraph 2 - Which species of fish and benthic organisms will be affected? Where specifically are these sensitive areas? Please locate the areas where water quality will be affected. How will the water quality impacts be minimized? Will different routes be evaluated to minimize or mitigate environmental effects?

Page 55, E - A determination should be made on whether all of the hazardous wastes need to be transported during this time of the year. Can certain types wait for more favorable weather conditions.

Page 96, Section B - Alllouez Bay should be included in the description offered [illegible]re.

Page 100, paragraph 3 - A portion of these presently undeveloped public lands may be used in the future as a dredge spoil disposal area.

Page 101, paragraph 3 - It should be noted that the bay is making a recovery. St. Louis Bay is worst in winter; however, with Western Lake Superior Sanitary District on line, we are expecting some gradual water quality improvements.

Page 102, Number 1 - Dredging will still be required in the general area. Areas having polluted sediments should be intensively located and mapped.

Page 108, paragraph 2 - It is possible that the regional treatment plant may create chloramine problems.

Page 109, Section b - The first statement appears unfounded. Data is not yet available to draw such a conclusion.

Page 111, paragraph 4 - The piping plover should be included on this list.

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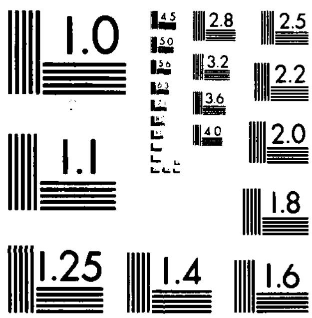

MICROCOPY RESOLUTION TEST CHART
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Page 112, Section b - The summary concerning adverse impacts does not take into account the secondary effects of the proposal (e.g. industrial development).

Page 113, paragraph 2 - This discussion on anticipated problems is inconsistent with the statements on pages 109(b) and 112(b).

Page 114, Number 6 - We suggest two additional recommendations be added:

3) Surveys of the harbor to determine fishery spawning, nursery and habitat areas, wildlife habitat, sediment quality and water quality.

4) Stringent environmental controls on development.

Page 118, paragraph 4 - Lake trout spawning has been observed on the Gull Island and Michigan Island shoals.

Page 119, paragraph 4 - Serious conflicts may also arise on the Gull Island-Michigan Island closed area. This is a major lake trout, whitefish and chub spawning area. These fish spawn in late fall, and the eggs require a lengthy incubation period. Thus, the eggs and larvae would be susceptible to disturbances during a critical life stage.

Page 120, paragraph 5 - More intensive investigation would probably reveal more bald eagle nests than the four mentioned.

Page 121, paragraph 5 - The piping plover also inhabits the Wisconsin Point area in Duluth-Superior harbor.

Page 123, paragraph 1 - Other significant impacts which should be listed here include fisheries and scenic shoreline.

Page 125, Number 6 - An additional recommendation should be:

(3) Complete fish and wildlife surveys in Chequamegon Bay and the Apostle Islands area.

Page 196, last paragraph - During the past two to three years, improvements in water quality have caused an apparent reversal in the long-term trend of decreasing dissolved oxygen concentrations.

Page 198, paragraph 5 - Sturgeon Bay should be added to the list of harbors having extended navigation. An ice breaker will be stationed here.

Page 199, "icebreaking" - A type 'C' icebreaker will be stationed at Sturgeon Bay (see pages 7 and 8) not Green Bay. Green Bay would have a private ice breaking tug (see page 17).

Page 233, paragraph 1 - The discussion of dissolved oxygen levels on the Fox River are no longer entirely accurate.

Page 233, paragraph 2 - Improving water quality has caused a resurgence of recreational activity in lower Green Bay. The City of Green Bay has considered reopening Bay Beach Park because of reduced fecal coliform counts.

Page 234, paragraph 3 - In fact, chinook salmon have been stocked at the DePere fairgrounds.

In summary, the Department feels that no long-term conclusions should be drawn and no commitments should be made based on the limited existing and unsubstantiated data. We emphasize the need for baseline data which must be collected on a ecosystem basis. However, the identification of informational needs and research studies must be commensurate with the anticipated environmental effects. Not only must we use our best judgement in designing suitable studies, but we must remain open-minded and flexible in the future as new information becomes available. We feel this is a reasonable approach to blending the scientific method with environmental problem solving. We are confident that the expertise is available in the various participating agencies to cooperatively conserve this largest and most unique freshwater ecosystem.

Sincerely,
Bureau of Environmental Impact

Howard S. Druckenmiller
Director

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